# AMATEUR WORK

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## A MODEL ELECTRIC RAILWAY.

ROBERT GIBSON GRISWOLD.

### III. THE TRACK.

For the successful operation of a model railroad, it is essential that the track should be especially well designed and built. A model seldom has the proportionate weight to keep it to the rails, and any slight inequality in the rail may tend to lift the wheel off the tread. Much, of course, depends on the finish of the wheel flange and tread.

In the construction of frogs and switches, care must be taken to have the points and joints well smoothed off, and the relative parts securely fastened together. As far as possible, in keeping with simple amateur construction, the track equipment will follow closely the designs in use on the standard railroads.

In Fig. 1 is shown a section of double track including two split switches and two single frogs. Since this is designed as a "third rail" system, it is necessary that the *third rail* should be mounted on either side of the track just outside the rail. This system, while requiring about double the quantity of third rail, is far better than the single rail especially where switches and frogs occur. If the car is moving slowly over these places the current may be entirely shut off the motor and it will come to a standstill.

Another method is to provide the car with two sliding shoes, one on either side which will materially reduce the resistance of the system. When two shoes are provided, the double third rail may be omitted except at switches and frogs. When the car passes these points one of the shoes will be in contact with a rail at all times and no break in the current will ensue. This is perhaps the most satisfactory arrangement. It will then make no difference in what direction the car travels, as a shoe is carried on either side of the car.

At *a*, Fig. 1, is shown the end elevation of the rails and a tie. The gauge of the rails is 2 $\frac{1}{2}$″ and the third rails are set $\frac{1}{2}$″ outside the rail-head. The rail used in this system is a special form made of rolled strip brass which may be obtained in six-foot lengths, is straight and true to size and the head is nicely formed. It can be fastened to the ties by small *gimp* tacks which have a button head, setting nicely over the flange of the rail. The third rail is merely a strip of brass bent into the shape of an L and secured to the ties in the same manner. If preferred, strips of metal may be substituted for the wooden ties and the rails soldered thereto. The ties are four inches long, by one half an inch wide, and one quarter of an inch thick.

The rails above mentioned can readily be joined together by means of a stud driven into the head of one of the abutting sections, the rail-head being hollow. File up such a stud from brass wire and fasten one into each rail with a little solder, leaving the other end hollow. Sections thus provided will match exactly and form good electrical contact. The third rails may be joined by soldering

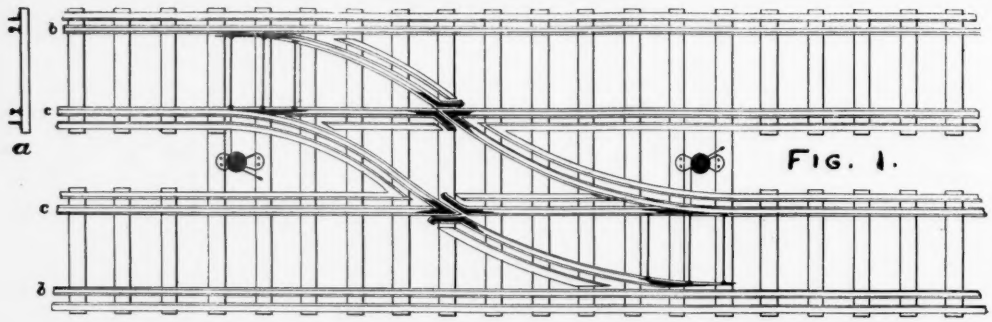



FIG. 1.

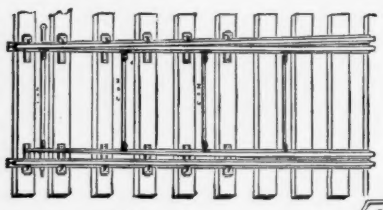


FIG. 2.

FIG. 3.

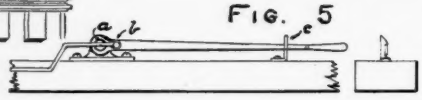



FIG. 5

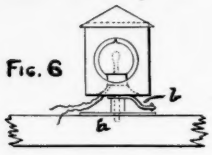



FIG. 6

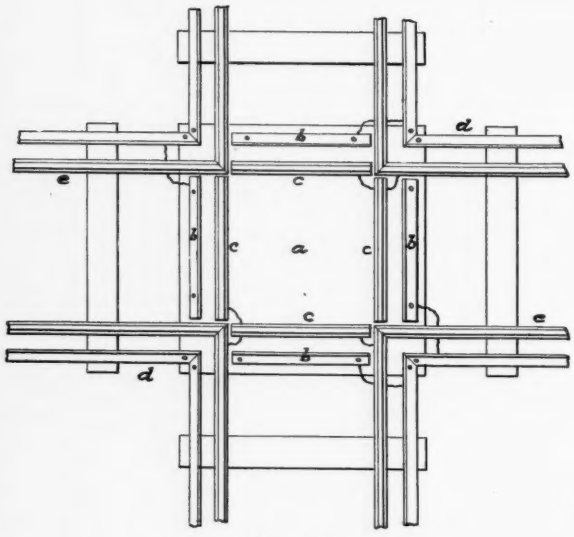



FIG 4.

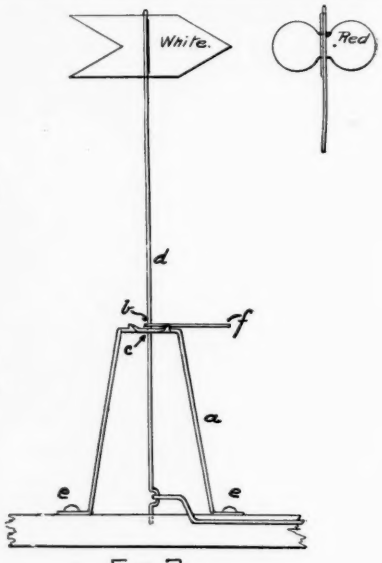



FIG 7.

to each side of one end, a small strip of brass thus forming a slat into which the abutting rail may fit and secure good electrical contact.

In making curved sections the rails should be annealed by heating to a dull red and plunging into water, (the ralling having rendered the brass very hard) lay out the curve desired on a $\frac{1}{2}$" board and carefully bend the rail to fit. Do not allow the flanges to double up while bending, as they have a tendency to do, but keep them fiat by hammering, as the bending proceeds. The inside rail, of course, has a lesser radius than the outside, and the board may be cut to its arc after the outer rail is finished. Make the ap-

proach to each curve very gradual so that the cars will take it easily.

In Fig. 2 is shown a knife switch drawn to a slightly larger scale than Fig. 1, showing the details more clearly. The rails are not cut for this form of switch as in the *stub* switch. The outside rail *b*, is curved straight while the inside rail is curved to form the end of the switch, and terminates in a point at the frog in the inside rail of the adjoining track. Take a piece of rail and file the end down to a long thin point and raise the flange so that it will clear the flange of the rail against which it lays. There should be no abrupt change at this point but the tapered end should lead away from the rail very gradually for at least a distance equal to the gouge. Make two such pieces for each switch and bend one to the curve of the turnout as shown in Fig. 1. These tapered rails are connected together by tie-rods shown numbered in the figure as Nos. 1, 2, 3, and 4. These tie rods may be pieces of wire soldered to the rail flange and are provided to keep the rails the correct distance apart and move them simultaneously. The rails are fastened to the ties directly beyond the last tie-rod and the further away from the point that the first fastening occurs, the more flexible will the switch be. One of the tie-rods, generally No. 1, is extended to one side for attachment to a ground lever for throwing the switch. In this case the wire may be bent down slightly to allow it to pass beneath the rail.

The frog will present the greatest difficulty in construction. The joints must be made smooth and nicely tapered. Fig. 2 is an illustration of a standard frog which shows the details of construction very clearly. Instead of placing a block between the tracks as here shown, solder the various pieces to a brass plate which will make a very solid and substantial frog. Lay the frog down on paper first so as to more readily measure the tapers required and then cut the rail to fit as designed. In all frogs the gap is so proportioned that when the wheel is passing over it the tread will rest on the rail beyond before it leaves the point, thus relieving this point of the great weight which would soon smash it. Do not allow more space for the flange between the tracks than necessary. In the practical use of frogs on railroads, a guard rail is provided, lying close to the outer rail but on the inside, allowing just sufficient space between the two heads for the flange to pass. The purpose of this extra rail is to prevent the wheel slipping to one side further than it should, and climbing upon the point of the frog which would, of course derail the train.

The third rail should be about $\frac{1}{32}''$ higher than the track-rail, so that the shoe will not cause a short circuit as it passes over the breaks. If care is taken in fitting these third rail sections, very small gaps can be secured and the sliding-shoe will pass over them freely in either direction. Wherever a break in this rail occurs, as at points where it crosses the track-rail and comes close to the frog, taper the ends towards the flange so that the shoe may not catch. Connect the various sections of third rail together by soldering wires thereto, so that no section will be "dead" when the car passes over it. It is also a good plan to connect the track rails together by soldering a wire between, at least one in each section. This will be found to materially reduce the resistance of the circuit, especially if one of the rail connections should be faulty.

In Fig. 4 is shown a cross-over together with the third rail and connections. The middle block *a*, is best made of one piece, and in the event of the crossover being made in a separate section, the piece *a* had better be extended to the position occupied by the ties shown. This method of construction will give support to the rails and prevent distortion should the section be lifted by one end, the design shown being intended for a permanent position. The sections of third rail *b* must be connected by wires to the live rails *d* as shown, which will enable the car to pass this section.

Mitre the joints of the rails and solder together to form a solid piece. The short rails *c*, must also be connected with the main rails *e*, so that the electrical continuity of the tracks may be preserved.

In Fig. 5 is shown a ground lever for throwing a switch. This lever is pivoted at *a* to a stand which is fastened to the tie. At *b* a link is pivoted which is fastened to the tapered end of the switch. In throwing the switch the lever is

thrown over and hooked under the catch *c*, which holds it in place against the tension of the switch.

A switch stand is shown in Fig. 6 which turns with the switch and shows a red or white light, depending on the switch position. Make a little stand *a*, of brass so that a stud fastened to the bottom of the lamp can pass through a hole and turn therein. To the bottom of the lamp is attached a short lever *b*, to which is fastened a link attached to the switch. This causes the lamp to turn a quarter turn with a full throw of the switch, showing white when closed and red when open. Make the lantern body of wire and provide the openings in the side with red and white glass. Inside the body is mounted a small pea lamp, connection with which is made by two wires passing through the bottom. Adjust the lamp so that it will show white when looking along the main track, while the switch is closed and red when the switch is open.

A vertical switch lever and target is shown in Fig. 7. The stand *a*, is bend up from a $\frac{1}{4}''$ strip of No. 20 hard brass to the shape shown. Drill a hole at *c*, for the rod *d* to pass through and two in the ends for screws *e*. At the upper end of the target rod is fastened a target made of tin and painted in the colors indicated. The connection with the track is so made that the target will show white when the switch is closed and red when open. A handle *f* is soldered to the target rod at *b* with which the rod is turned, thus throwing the switch.

# CUTTING TOOLS FOR PLANER OR LATHE

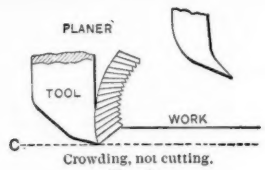
W. J. Kaup.

Planer tools will first come under our notice as being the simplest and requiring the least skill in setting. You have doubtless observed that if the chip be unwound from the spiral shape it assumes in leaving the tool, and projected in a straight line it is shorter than the surface from which it came. This is due mainly to the compression of the metal in the direction of the cut, and you will thus see the possibilities of saving power and strain upon the machine by giving proper cutting angles to the tools and reducing this compression to a minimum.

In Fig. 1 the cutting tool is at right angles to the work and without rake. It exerts its force in a direction nearly parallel to the surface of the work and having no side rake, either, it simply does not cut, but shoves or crowds the metal forward, producing a chip made up of little splints. It cannot exert any force tending to lift or curl the chip.

This tool is wholly wrong; nor would it materially improve it to grind like the tool shown in the little sketch at the right, which goes to the other extreme, and would spring into the work. A tool must first of all be heavy enough at the back or heel to resist the horizontal cutting force, and consequently should have very little clearance. The 7 degrees clearance shown in the lathe tool in the upper view, Fig. 2, is too much for a planer tool, while the 3 degrees of the lower sketch is as small as can be used safely. Theoretically if the point leads by only a thousandth or two it will perform its function. There should be very little top rake on account of its tendency to make the tool dig into the cut; but this can be compensated for by giving considerable side rake.

Another reason why a planer tool tends to dig into the work is illustrated in Fig. 3. Point *A* in each sketch is the fulcrum. In the first sketch the tendency is for the tool to dig into the work in the direction of the arrow. This is not so serious as appears on the face of it, as planer tools are usually so stiff that they will spring but little and any error that might occur in the roughing cut would be eliminated in the finishing cut. What many mechanics take as an indication of the spring of the tool is really due to the chatter of the planer; since a rack and pinion planer will frequently chatter after it has become worn, while in a worm-driven planer the lost motion is all taken up at one end before beginning the cut and the screw action does away with the chatter.




Crowding, not cutting.
No rake.

Fig. 1

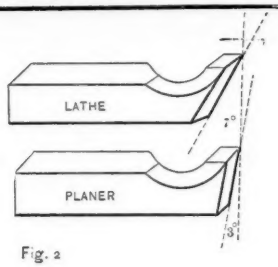



Fig. 2

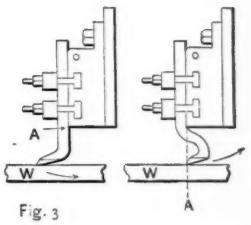



Fig. 3

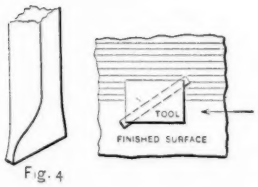



Fig. 4

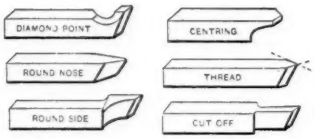



Fig. 5

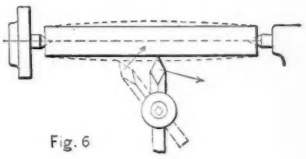


Fig. 6

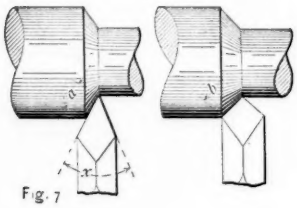


Fig. 7

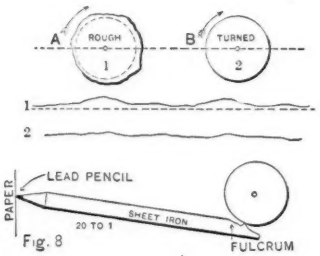



Fig. 8

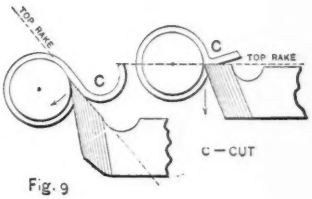



Fig. 9

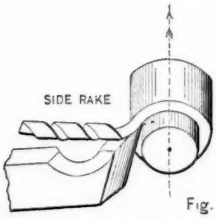



Fig. 10

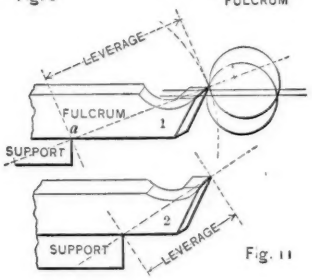



Fig. 11

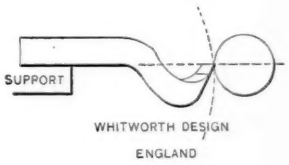



Fig. 12

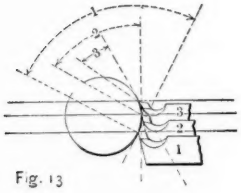
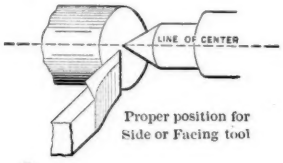



Fig. 13




Proper position for
Side or Facing tool

Fig 14

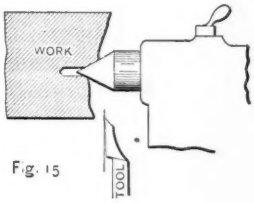



Fig. 15

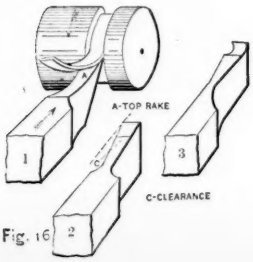



Fig. 16

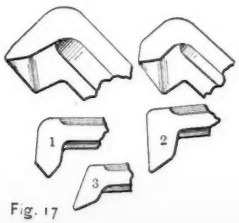



Fig. 17

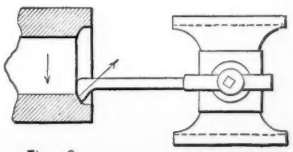


Fig. 18

Industrial Press, N.Y.

To obviate any spring the tool may be designed as in the second sketch, Fig. 3, where the deflection due to the force of cut is away from the work in the direction of the arrow.

The tool in Fig. 4, approaches the ideal for a finishing tool, and gives the best finished surface of any that I have used on planer or shaper. It is made from a piece of ordinary tool steel and forged on the end in the shape indicated. It will be noticed that it has side rake and instead of being straight on the bottom, the line that comes in contact with the work is a little rounding.

We will now take up the subject of the cutting edges of some of the many varieties of lathe tools, Fig. 5. Here are shown a diamond point, a round-nose tool, a side tool, centering tool, thread-cutting tool, and cutting-off tool. We will first consider the diamond point as it is more of a universal tool than any of the others. Before speaking of rake, clearance or the setting of the tool, I want to call attention to the general form of the cutting edges and the importance of maintaining the same throughout the life of the tool.

Fig. 7 will best illustrate my meaning. The tool is shown at the left with depth of cut, and ground so that angle $x$ shall not be less than 55°. To the right is a tool in which the angle has been changed by grinding on both sides of the point, only, because the machinist claims that he is in a hurry and must make time on his work. But it will be seen that the line of cut $b$ is much greater than the line of resistance $a$, showing loss in efficiency in the tool and requiring more power to drive it after it had been ground. Nor is this the only reason why careless grinding will produce a loss, as I will proceed to prove.

This is true with proper rake, angles and clearances, but when the mechanic ignores all principles, and is careless besides, how much more serious it becomes, because more finishing cuts will be required to make the piece straight. The nearer the cutting edge of the tool comes to being parallel with the axis of the work the more power will be required to operate the tool.

It will be interesting to note what really takes place in turning, as shown in diagrammatic form in Fig. 8. Here is represented a piece of rough stock that is to be turned as indicated at the right. First, starting at the corner line $A$, and developing the line of circumference in a straight path, we will get a line like (1). After turning and repeating the process, the developed line will look like the line at (2). It will be noted that the second line is somewhat irregular, showing that even after roughing it off, the surface of the piece has nearly all the irregularities of the rough stock, though on a smaller scale.

This brings us to another important point, and that is the necessity of centering work as accurately as possible, for no matter how even the work may be on its circumference, if centered out of true, it will not be round after turning. Why? Because the thickness of the chip or shaving is not uniform, hence does not offer uniform resistance to the cutting edge and the work will bend more at one point than the other. If the cut were uniform and offered the same resistance, of course we could expect round work.

The bottom figure on the sketch illustrates the tool and method of obtaining the lines. A long light lever has a knife edge or point at one end, near the fulcrum, which bears against the periphery of the work. On the other end is a lead pencil attachment, the point bearing against the piece of paper indicated, the paper traveling at the same rate of speed as the work, only in the direction of the axis of the work. An unevenness in the surface of the work raises or lowers the point of the pencil and as the ratio is great (20 to 1), the variation in the line is marked.

Referring to Fig. 2, we will take up the rake and clearance of lathe diamond point tools. The angle or clearance, sometimes called the angle of relief, as indicated here, is about 7°, and sometimes runs to 10° more or less; enough for a safe working angle. Really, the only reason for so much clearance is to avoid rubbing against the cut surface, thereby causing unnecessary frictional resistance to the motion of the lathe. Our efforts should be directed towards finding the angle that will give the least force required for cutting, combined with endurance of tool edge.

While the power required to cut is increased greatly by dullness of the cutting edge, we must avoid the wood chisel edge because time lost in constantly removing the tool for grinding purposes eats up the profit. In Fig. 9 are illustrated two extreme cases; that on the left, too great top rake and the other without any. The one will do good work for a few minutes, provided

the cut is not too heavy, but the wear of the edge is so great that the angle would soon become blunt and it would be very much better to have no top rake at all. On the other hand, the cutting wedge, as I will call the tool ends on the right, is too blunt to do good, clean work, and from the position in which it is set, the chip will come off nearly straight and in small pieces. The happy medium between the two is indicated in Fig. 10.

Side rake means the angle at which the top is ground either to the right or left side. A tool ground for a traversing motion toward the left-hand, cannot be used with a motion toward the right. Therefore side rake is designated right-hand or left-hand, the former being that which has its cutting edge on the right side and the latter on the left side. As the side rake is increased the power to drive it on its traversing direction becomes less as it tends to screw its way along.

Fig. 11 illustrates an important point in setting the tool. The further the cutting edge is from the base, or support, the greater will be the spring. Where this spring is possible the point is drawn into the work as indicated by the dotted line, and furthermore, will produce irregularly shaped work due to the variation in the resistance of cut at points where the tool digs in. This indicates the value of short leverage.

In Continental shops, and especially in England, it has become a recognized principle that the top of cutting edge of tool should not be higher than the top of the support and to obtain its top rake the tool is hollowed out by grinding. Sir Joseph Whitworth designed his lathes so that the tool set on the centre of the work, and any vertical pressure deflected the tool away from the work, as shown in Fig. 12.

Next in importance to the leverage of the tool is the angle at which it is set in relation to the work. Referring now to Fig 6, the tool is shown at right angles to the work and the cutting pressure tends to force the tool around to the right, away from the work, in the direction of the arrow, instead of causing it to dig into the work. If the tool were set as shown in the dotted position it will readily be seen than any slipping or deflection would carry it into the cut.

The third point to be observed in regard to setting the tool is its height relative to the lathe centres. Fig. 13 illustrates this. Tool No. 1 is set below the centre and the dotted line, drawn tangent to the point of the tool on the periphery of the circle, indicates the direction in which the cutting force is applied. The top or cutting surface of the tool forms an angle of 90° with this line. The stock is thus merely crowded off by the tool and there is no cutting or wedge action but still not what it should have. The top tool, No. 3, gives us the best cutting wedge and will do maximum work with minimum resistance.

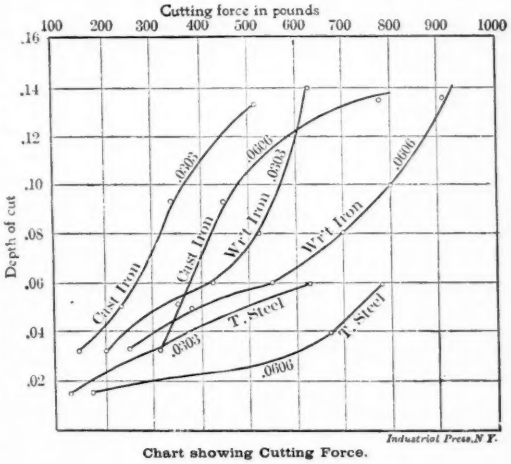



Chart showing Cutting Force.

From the foregoing it is clear that the lathe tool will do the best work with combination of top and side rake, when caught very short, at right angles to the work, and when set above the centre. This will lead to economy.

Now a point about grinding: The diamond point tool should be ground only on the top, and the angles on the sides should never be touched, and there will be no danger then that you will destroy the economic value of the tool. Many mechanics burn the cutting edges of the tool in grinding, by simple carelessness, which makes the edge softer than the metal it is supposed to cut. My references thus far have been confined entirely to the solid tools, most commonly used. But there are many improved tool holders in use, designed for self-hardening steel which is not affected by burning in the hands of incompetent mechanics, either in grinding or through of knowledge of the proper cutting speeds. These holders support the steel in such a position as to

give the proper front and side clearance and the rake is determined by the grinding.

Following is a table of finishing speeds and feeds for different metals for tools of ordinary tool steel. In roughing the axiom is slow speed and quick feed; finishing high speed and fine feed. From this table I should deduct 25 per cent. for roughing speed, making 18, 24, 28 and 83. Experiments on cutting tools made in the shops of R. H. Smith, London, England, and verified by the author, show that machine steel requires from two to two and one-half times the power for cutting, as does cast-iron, and wrough-iron, about one and one-half times the power. The results are given in detail in the chart herewith and show that an increased force is required for increased cutting speed.

LATHE AND PLANER CUTTING SPEEDS AND FEEDS.

| Tool Steel. | | Wrought Iron Machine Steel. | | Cast Iron. | | Brass. | |
|---|---|---|---|---|---|---|---|
| S | F | S | F | S | F | S | F |
| 24 | 25 | 32 | 25 | 38 | 22 | 110 | 20 |
| Lub. | | Lub. | | Dry. | | Dry. | |

F = Number of revolutions to 1 inch feed.
S = ,, ,, feet per minute.

The round nose tool, Fig. 5, is used for brass when made rather pointed and for facing cast iron when it has a blunt point. The tendency with brass, which is very soft, would be to pull a hooked tool into the work. The side tool should always be set with the point leading slightly, but remembering that it is not the point but the side of the tool that is to do the cutting. This tool should be set on the centre, as indicated in Fig. 14. Fig. 15 shows the necessity for facing up work with the side tool before turning; otherwise the centre will give more support to one side of the work than the other, and the pressure of the tool used later for turning will be likely to produce a crushing of the metal at the centre, on the side of the least support.

The centering tool should be ground like a twist drill and placed with its cutting point directly at the centre of the work and used to obtain an accurate centre for starting a drill. Much carelessness is exhibited in the use of the thread cutting tools not so much in grinding as in setting. It should be set so that the cutting edges are directly on the line of lathe centres and of course, at right angles to it. The economical way to use this tool is to rough out the thread with a heavy cut and then regrind the top face until again sharp and then finish with a light cut. No matter how carefully a thread tool is used, the sharp point will wear rapidly.

Referring to Fig. 16, we come to the cutting-off tool, the last of the lathe tools shown in Fig. 5. The upper view shows the action of the tool and the two lower views indicate how good and poor results may be obtained through grinding. This tool has side clearance, right and left, and should be ground slightly concave on its top face. Its point should be on a level with the centre of the work.

In Fig. 17, are indicated several of the commoner types of boring tools. The vertical pressure on boring tools is very constant (Fig. 18). and when the tool starts to cut, the depression or spring downward remains very nearly constant throughout its entire cut, and so does not vitally affect accuracy. The tool wears as it advances, however, and this tends to produce a conical hole. Lathes are adjusted, also, so that in no case will they bore a hole larger at the back than at the front, and in making this adjustment the tendency is to have the lathe so it will bore very slightly smaller at the back; another reason why bored holes are frequently a little tapering.

*Machinery.*

---

A telegram from Ashkabad states that two million acres of cotton, wheat, barley, and vegetable crops in that fertile district of Russian Central Asia have been completely ravaged by swams of locusts.

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A 100″ driving-wheel lathe, capable of taking in wheels of 100″ diameter, is one of the new machine tools installed at the shops of the Chicago, Milwaukee, and St. Paul Railway at West Milwaukee, Wisconsin. In a test made with a pair of 84″ wheels the tyres were turned simultaneously, with an average depth of cut of $\frac{5}{16}$″ at each tool and a feed $\frac{3}{16}$″, says the *Engineer*. The cutting speed was 18 ½′ per minute, and the work was done in sixty-three minutes. The average power required at the motor was 16 ½″ horse-power, increasing to 22 ½″ horse power when hard spots were encountered by the tools.

# BROWN PRINTS INSTEAD OF BLUE.

JAMES THOMSON.

The blue print as a means of artistic expression, is no doubt the simplest method of sun printing available for photographic purposes, but the Color is a serious objection, for the generallity of subjects it will not do. In the photo miniature and in other directions we find instructions to enable us to change the objectionable blue to other colors, notably black and brown. The person who devised these methods must have had exceptionally good fortune in his efforts, or perhaps is one that is easily suited, for no one else, I am certain has ever succeeded in getting any other result than dingy prints from following the printed directions.

But why waste time in trying to make an imperfect way that which can be had to perfection by other more simple processes. For example, plain silver paper and kallitype. Eastman's sepia paper gives beautiful rich browns and is as cheap and simple in manipulation as the blue print. Some who have failed with it have had old paper forced upon them. Stale paper brings a train of disappointments.

The purpose of this article, however, is to instruct the readers of this magazine in a method of preparing for themselves paper in every way as good as those mentioned, and giving brilliant brown effects without toning, having the additional good quality of being as cheap and easy to produce as a blue print.

In one of my experiments I stumbled on this formula. Whether it is something very original I know not, but this I know: I have never seen it in any publication that has come my way. Whether new or old, it is something worth knowing.

For a foundation a good firm non-porous paper is essential, any paper that is of the nature of cardboard will not answer. A cream laid smooth surface writing paper will do, and if extra brilliant effects are desired a size of starch or arrowroot should be applied and then thoroughly dried. The salting solution is as follows.

Distilled or boiled water, 1 oz.
Citrate of iron and ammonia, 90 grains

Coat the paper thinly and evenly with this, either with a brush or tuft of absorbent cotton, and when surface dry complete by artificial heat. Then apply the sensitizer, which is herewith given:

Distilled or boiled water, 1 oz.
Silver nitrate, 50 grains.
Citric acid, 20 grains.

Press rather hard in coating so as to take off as much as possible of the superfluous iron solution from the surface, which if permitted to remain will make more than the desired contrast. Printing with the proportions mentioned is very rapid, a well defined tawny image being produced in a few minutes. Stop the printing before fully brought out, under print because the image will develop some in the washing. When printed wash away the unaffected salts as with a blue print, then transfer to the fixing bath composed of 2 grains of hypo to the ounce of tap water, where the print will immediately begin to darken. Three minutes in the hypo is usually sufficient' five minutes at most, as the image loses in strength when left too long. Wash for twenty minutes and dry between blotters or clean papers. The resultant prints should be a rich brown and may be further darked by the application of heat. Should the contrast be too great dilute the iron solution (which regulates the contrast). However, if this is done, it slows the time of printing. The stronger the iron solution the quicker the printing and the greater the contrast, hence the value of this method for overtime negatives which ordinarily are useless. For rough papers it will be necessary to use say 60 grains of iron to the ounce of water. I have always used the iron and silver separately because I got good results, but these may work all right mixed just before applying and one coating made of it. The great drawback with the paper is its non-keeping qualities. It deteriorates quickly and no more than

can be used in twenty-four hours should be prepared at one time. Some one with more knowledge of the subject than the writer may be able to devise a preservative, making the paper thereby of more value commercially.

Such a paper ought to be of value to architects in producing easily and cheaply pictures of house illustration, etc.

Further investigation convinces me that prints should be left in the hypo. only so long as they retain their vigor and brilliancy, regardless of time. Some prints will reach their best in thirty seconds, while others can with safety be left five minutes, Long immersion causes fog and general deterioration. Properly manipulated, this process will produce prints to equal in graduation any Kallitype or Platinotype, while results from improper working are chalky high-lights and loss in the half-tones. *Western Camera Notes.*

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The ratio between bore and piston stroke of modern petrol motors, according to the average of the motors fitted on cars taking part in the Automobile Club's trial, is 100, 115.6. The cylinder capacity averages 183.3 cubic centimetres per brake horse-power.

---

Prof. Lombroso has a curious prejudice against ambidexterity. In last month's *North American Review* he gives the results of his observations on left-handed and left-sided people. They are of such a character to make people hesitate even to stretch out the left hand, and it is small consolation for him to make the closing qualification: "I do not dream of saying that all left-handed people are wicked, but that left-handedness, united to many other traits, may contribute to form one of the worst characters among species." Even that he further discounts by bringing up the Tuscan proverb. "He is left-handed," as used to express the idea that a person is untrustworthy. The professor finds that among 1,000 soldiers and operatives the proportion of left-handed people is 4 per cent. among the men and 5 and 8 per cent. among the women. Among criminals the quota of left-handed was found more than tripled in men and more than quintupled among women.

## MACHINE DRAWING.

CARL H. CLARK.

Fig. 1 shows the most common forms of riveting *a* is the ordinary cone head rivet, *b* the round head rivet, and *c* the countersunk head rivet, the latter being used where it is desired to have the surface flush, *d* shows the simplest kind of hand riveting where the head is formed by hammers only, it is left rounded with no particular care as to finish; *e* is the countersunk riveting, used where a smooth surface is desired, as in the plating of vessels, it is very slightly rounded as shown, *f* is the ordinary round head riviting, found by heading over roughly with a hammer and finishing with a swage, or cup shaped tool which is placed on the rivet and hammered, forming the head round. *G* is the best type of hand riveting, the head thus formed being a perfect cone, and care being taken to have it smooth and even. It is used in steam boiler work.

Any of the heads shown may be combined with any of the methods of riveting over, etc., according to circumstances, as for instance, in machine riveting both head and point are round to fit the cups formed in the machine.

Fig. 2 shows some of the ordinary types of bolts, *A* is a square headed bolt with a square nut. *B* is the three views of a nut, *C* shows a filetster head with a hexagonal nut and a washer. This head is used where a good finish is desired. *D* is a tap bolt with a countersunk head, used where a flush surface is wanted; it is screwed in with a screw driver, *D* and *E* are used where a nut cannot be fitted, *E* is a tap bolt with a hexagonal head, *F* is a stud bolt with a double thread and a plain part between; it is screwed in until it reaches a bearing, after which the nut can be screwed on, Fig. 3 shows the three views of a square headed bolt with a washer and hexagonal nut, Fig. 4 is the working drawing of a simple cast iron bearing, Fig. 5 is a wrought iron eye bolt, Fig. 6 is a split pin, used to prevent bolts and pins from becoming displaced; it is put through a hole in the bolt and the ends separated enough to keep it from working loose. It is to be noted that in most machine drawings, especially the simpler ones, all of the three views heretofor used in projection are not required, as in Fig. 4 only two are needed, and in Fig. 5 only one.

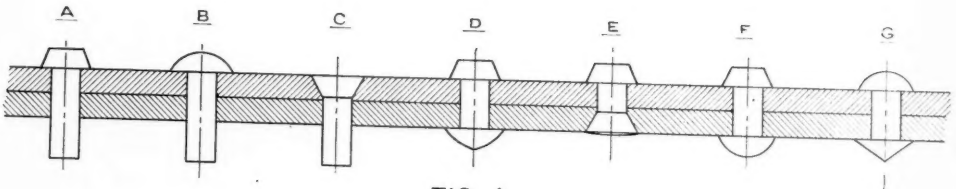


FIG. 1

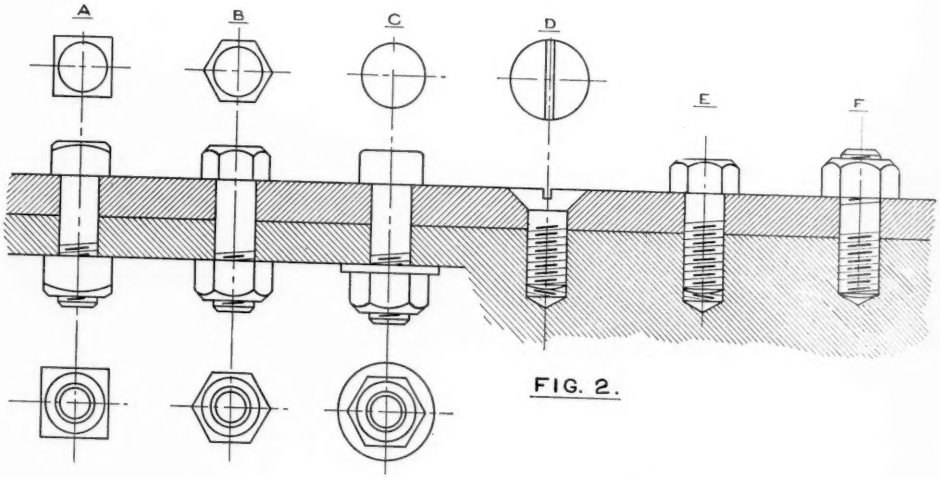


FIG. 2.

FIG. 3.

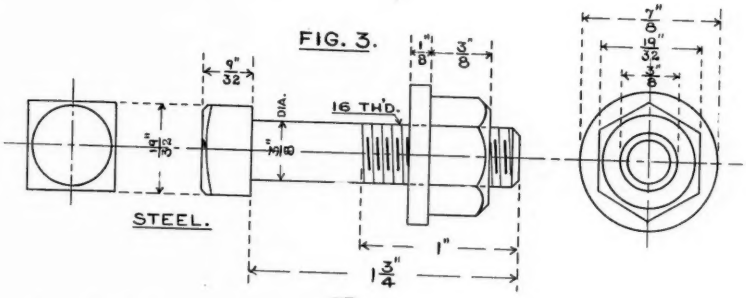


FIG. 4.

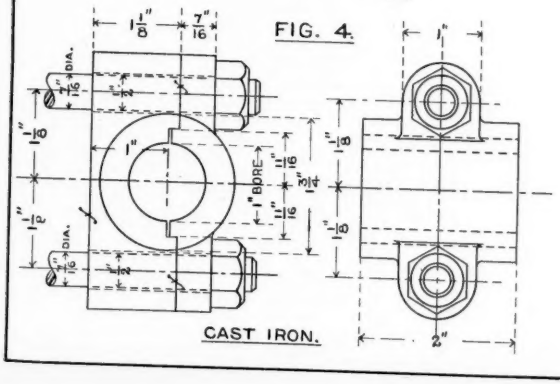


FIG. 5.

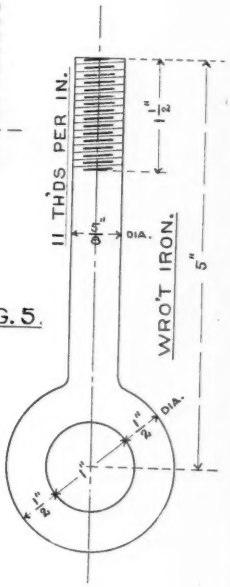

FIG. 6.

# MICROSCOPHY FOR AMATEURS.

S. E. Dowdy. M. P. S.

The microscope nowadays plays such an important part in scientific work that its claim to be called an instrument of precision and value is hardly likely to be disputed.

Microscopy as an intellectual pastime has, however, to a great extent been neglected for the pursuit of other branches of natural science, and yet microscopy can lay claim to advantages not possessed to anything like the same extent by its rivals in the esteem of the youth of scientific proclivities.

In the first place, the instrument is comparatively inexpensive, it takes up little room, interesting objects are always available, and favorable conditions for viewing them are well within the observers control. Without wishing for one moment to disparage the pursuit of that branch of astronomy which particularly appeals to the amateur – viz., telescopic observation of stars, planets, and nebulæ, can as much be truthfully claimed for the astronomical refractor or reflector? Of course, there is no reason why the two branches of science should not be taken up by the same person to advantage, the training to which the eye is subjected in microscopical work being conducive to more accurate observation of detail in astronomical work with the telescope; but if it is desired to keep to one subject, I for one do not think the beginner will be disappointed if he gives microscopy the preference. An erroneous impression no doubt exists that special skill and study are required, even if the microscope is to be used for recreation only. This is far from being the case, as any intelligent person should be capable of deriving profitable amusement after a few hours possession of the instrument. At the same time no piece of apparatus requires more technical skill to handle it, if first-class results in critical research work are desired, and this in itself, by developing the individuality of the observer, constitutes one of the most forcible arguments in its favor from the educational point of view. Neatness, patience, dexterity in manipulation, are required of the successful microscopist, and the acquisition and cultivation of these qualities will fit him for success in other, perhaps widely different, spheres of activity.

Realising that it is frequently due to very hazy notions as to the cost, capabilities, and usefulness of the microscope, that many a wood-be microscopist is deterred from taking up this facinating study, with the Editor's kind permission, I propose to pen the following hints and suggestions for the use of those who are quite unacquainted with this branch of science. For this reason I have used the term "Microscopy for Amateurs" at the head of these communications. In the strict sense of the term, most of our leading microscopists are amateurs, pure and simple. In this case the reader must take the word as synonymous with beginner. Starting with a few explanatory words regarding the early history of the instrument, we can then proceed to a brief description of a modern student's microscope, indicating how its lenses and adjustment may be tested, and pointing out a few common objects for early observations, with the hopes that any feeling of interest in the subject which may perchance be aroused may not be transient, but may lead to the formation of those habits of accurate observation which have in the past and will in the future do so much to enrich the sum of human knowledge.

The name of the first person who conceived the idea of enlarging the images of minute natural objects by means of lenses is unknown. The origin of the microscope is therefore still wrapped in obscurity, the credit of its invention being ascribed to first one individual and then another, as fresh evidence comes to light. Some claim the honor for Galileo, others for Janssen, a Dutch optician, though they are by no means the only candidates in the field. The probability is that in its simplest form, as a convex lens, it was known at a much earlier period; possibly to the Romans or Egyptians. It is fairly safe to assume that the compound microscope was not known before the invention of the telescope,

which probably preceded it; but the actual date of its origin, or the name of its originator, is a matter of doubt. At all events, it is a comparatively modern invention, taking the length of the civilized period of the earth's history as a standard. From a plaything for the scientists of the Middle Ages, it has won such recognition of its capabilities and adaptability that no modern laboratory, medical school, or similar scientific institution can dispense with its services.

Great simplicity of construction marked the earlier stages of the history of the microscope, the mechanical adjustments, as might be expected being crude in the extreme. This, however, was in keeping with its optical portion, which, owing to want of knowledge of the laws of light and methods of giving the necessary curvatures to the lenses, was, of course, defective. This fact probably induced the great naturalist, Leenwenhoek, to discard the compound for the simpler microscope, which could at that time be relied upon to give more faithful images. The possibilities of the compound instrument were, however, not lost sight of, and we find various modifications introduced from time to time, until about the year 1800 it began to assume much the general outline with which we are now familiar. It was also about this time that the optical portion was receiving increased attention, and though the theory of the achromatism of lenses was imperfectly understood, we find attempts being made to give the necessary correction to the objectives, so that clearer images might be obtained. To enter fully into details concerning the evolution of the modern microscope would fill a fair-sized volume, a few lines cannot do justice to it.

To those interested in the subject, a perusal of that part of "Carpenter on the Microscope" devoted so the history of the instrument will show that the modern instrument is the result of much patient work, with which the names of many famous men of science have been connected. Of late years strenuous efforts have been made to incorporate the results of the latest researches in certain branches of chemistry and mathematics in the preparation of glass and the figuring of lenses, with the result that a first-class modern microscope is a triumph both for theoretical and applied science. What is still more important to the amateur, though, is the fact that, through increased interest in the subject and competition amongst readers, a really excellent microscope can now be obtained at a very low cost. After the purchase of such an instrument; a very small additional outlay will enable the beginner to do good work with it; or if recreation be the end in view, many pleasant hours may be spent in its company, and a first-hand acquaintance with some of Nature's minute marvels be made; an acquaintance which, in the majority of cases, will deepen the wish for a more intimate knowledge of the subject.

---

The history of lead pencil making goes back three or four hundred years. The lead pencil derives its name from the fact that before the time when pencils were made from graphite, metallic lead was employed for the purpose. Graphite was first used in pencils after the discovery, in 1565, of the famous Cumberland mine. This graphite was of remarkable purity, and could be used without further treatment by cutting it into thin slabs, and encasing them in wood. For two centuries England enjoyed practically a monopoly of the lead pencil industry. In the eighteenth century, however, the lead pencil industry had found its way into Germany. In 1761, Caspar Faber, in the village of Stein, near the ancient city of Nuremburg, Bavaria, started in a modest way the manufacture of lead pencils, and Nuremburg became and remained the centre of the lead pencil industry for more than a century. For five generations Faber's decendants made lead pencils. Up to the present day they have continued to devote their interest and energy to the development and perfection of pencil making. Eberhard Faber, a great-grandson of Caspar Faber, emigrated to the United States, and, in 1849, established himself in New York City. In 1861 he erected his pencil factory in New York, and thus became the pioneer of the lead pencil industry in the United States. Since then four other firms have established pencil factories there. Wages, as compared with those paid in Germany, were very high, and Eberhard Faber realized the necessity for creating labor-saving machinery to overcome this handicap. Many automatic machines were invented, which greatly simplified the methods of pencil making, and improved the product.

# AMATEUR WORK

7 7 WILBY ST., BOSTON

DRAPER PUBLISHING CO., PUBLISHERS.

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Entered at the Post-office, Boston, as second-class mail matter Jan. 14, 1902.

## NOVEMBER, 1903.


The "Suggestion Offer" is again called to the attention of readers. Anyone sending us a brief description of anything which would be of general interest, and which is accepted for publication, will be given the choice of any premium in our premium list offered for one subscription, subject to any condition of extra payment mentioned. Suggestions, to be acceptable, should give sufficient details so that the subject can be properly written up by one of our staff writers. When possible, drawings or a photograph should also be sent. Quite a number of our subscribers have received premiums under a previous offer, which is now made open at all times.

The premiums selected to supplement the Grand Premium offer made in the September nnmber of a Screw-Cutting Lathe are as follows: For the second largest list, Choice of either a Kent Dynamo-Motor, or a Rich Drawing Outfit. For the third largest list, Set of Fine Drawing Instruments. For the fourth largest list, Choice of a Seavey Mitre Box, Volt or Ammeter or Water Motor.

These are to be given in addition to the regular premiums allowed for subscriptions. A little extra work before the end of the year may secure one of the extra premiums. Make a trial and see what you can do.

The second volume of this magazine, Nov. 1902, to Oct. 1903, is being bound in cloth, and will be ready about the time this nnmber is issued. It will be sent, postage paid, for $1.50 or with a subscription for one year to begin with any number for $2.25. A reprint of the first volume is in progress, a copy being sent, postage paid, for $1.50.

Renew your subscription promptly. This is one of the matters likely to be overlooked unless attended to at the proper time.

## BOOKS RECEIVED.

DISEASES OF GASOLENE AUTOMOBILES AND HOW TO CURE THEM. A. L. DYKE AND G. P. DORRIS, 210 pp. PRICE $1.50. A. L. DYKE, ST. LOUIS, MO.

The rapid increase in the use of gasolene engines as the motor for automobiles, launches, and stationary purposes has, as might have been expected, been the occasion for numerous books and other publications devoted to the same. The one above mentioned contains a great deal of information which would certainly be of great value to engine operators and owners. A novel yet valuable feature of this book is the large number of clippings from the various publications and answers to same which have been included as a part of the matter presented. Nnmerous illustrations supplement the text. Had the typographical work been better the book would have presented a more satisfactory appearance, but in view of the information conveyed this will be overlooked by most readers. It is certainly well worth the money to any owner of an automobile fitted with a gasoline engine.

THE A. B. C. OF PHOTO-MICROGRAPHY. W. H. WAMSLEY, F. R. M. S., F. A. A. A. S. 155 pp. PRICE $1.25. TENNANT AND WARD, NEW YORK.

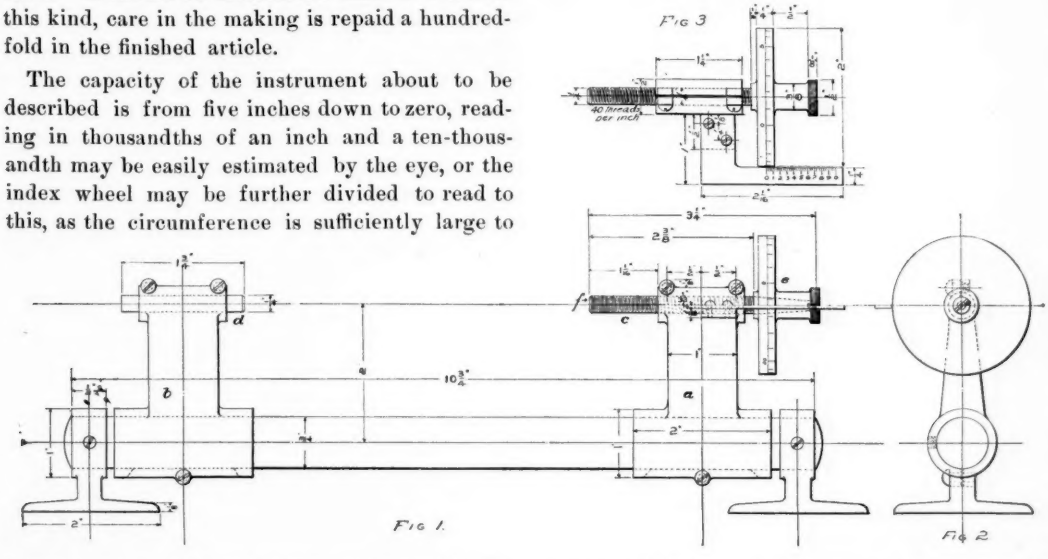
This book is intended for those who are totally unacquainted with this most interesting branch of scientific work, and gives with much detail the instructions necessary to surmount the obstacles which beset a beginner, a feature not covered by other works upon this subject. To those who are not familiar with the subject matter of this book, yet who delight in photographic and microscopic work, the reading of its pages will be extremely profitable. Thirteen plates illustrating photo-micrographical subjects add much to its value. It 's well and plainly written and is certainly a valuable addition to the literature of this subject.

# A BENCH MICROMETER.

R. G. Griswold.

A bench micrometer is a very handy tool for the amateur who is doing a high class of work in which accuracy of measurement is essential. In the physical laboratory it is almost indispensible for comparison of lengths. While it is an instrument of precision, its construction is not difficult to those accustomed to using tools and a lathe. It should be understood that in a tool of this kind, care in the making is repaid a hundredfold in the finished article.

The capacity of the instrument about to be described is from five inches down to zero, reading in thousandths of an inch and a ten-thousandth may be easily estimated by the eye, or the index wheel may be further divided to read to this, as the circumference is sufficiently large to permit such divisions being easily read. The travel of the micrometer screw is one inch, and with the aid of distance pieces the two measuring points may be set to measure any distance within its capacity.







Considering the frame or bed first, we have two pedestals upon which the instrument stands on the bench or table. These may be made of either cast iron or brass, turned to size and polished. The under side of these pedestals should be slightly recessed, either in the pattern, or by running a light cut over the surface in the lathe. This will enable the instrument to stand more firmly upon the table. The beam passes through $\frac{3}{4}$" holes drilled and reamed in the ends, being held in position by the set screw shown.

The beam, which is 10 $\frac{3}{4}$" long x $\frac{3}{4}$" in diameter should be turned down from $\frac{7}{8}$" stock and if possible, finished by grinding, so that it may be true to size and perfectly straight. If it cannot be ground conveniently, then finish it with a fine grade of emery cloth wrapped over the end of a stick and held in a tool post of the lathe. By running this to and fro over the surface with plenty of oil, a satisfactory surface may be had.

The two stocks carrying the measuring points are made from the same pattern with the exception of the lug which carries the small scale along which the index wheel passes. This may be cut off the stock *b* when cast, thus saving an extra pattern. If a lathe is convenient the longitudinal holes in these stocks should be drilled on it in the following manner:— Make a small angle or "knee" plate which can be bolted to the face plate of the lathe, being careful to have the two sides at right angles. Secure the stock, which should previously have been finished by filing until nearly to size, to this angle in such a manner that the axis of the hole to be drilled will coincide with the

center line of the lathe centers. This clamping is most readily accomplished by passing a flat piece of iron, say 1″ wide by 1-4″ thick, over the piece and passing two small bolts through holes in the ends into the angle plate. When securely fastened, place a drill slightly smaller than the finished size of the hole in a drill chuck held in the tail stock, and carefully drill the holes for the measuring point and the beam. By simply moving the angle plate across the face plate without loosening the clamp on the piece, the two holes may be drilled parallel, which would be difficult if either hole was drilled after removing the piece. Before passing from one hole to the other, pass a reamer through them to finish to size. It is well to state that the hole in stock *a*, which carries the movable screw, should be drilled to the root diameter of the screw to allow of threading, which must be done without moving the piece on the face plate after drilling the hole. Make a small thread tool which will pass into the hole and secure in tool post. Set the gears to cut 40 threads per inch. Take very light successive cuts, as this will ensure a perfect thread and avoid to a great extent the springing of the tool which would make an uneven thread.

When these holes have been finished, the piece should be split with a small saw as shown, and two machine screws provided at the top and one at the bottom to serve in clamping the spindles fast. The split in the bottom does not extend from end to end but stops about $\frac{3}{16}$″ from either end. The screw in the middle will compress the sides sufficiently to firmly grip the beam, and the ends of the hole not being cut through makes an excellent guide. This split is put in with a small circular saw, but if one is not convenient, the split is run completely through as in the top.

The splindle *c* should be made of tool steel and hardened after the thread is cut, but as this process generally warps the piece, unless the amateur is familiar with this class of work it would be better to leave the body soft and only harden the end which comes in contact with the piece to be measured. Cut the thread 40 per inch and make it a snug fit in the stock *a*. The end upon which the index wheel fits is tapered and the wheel held thereon by a screw in the end. When this spindle is inserted in its nut, the binding screws should be set down with only sufficient force to make the screw turn firmly, or with a slight resistance and with no lost motion. After the end *f* is hardened, the spindle should be held in a chuck and the end ground perfectly square and flat. If no tool-post grinder is handy, the same result may be more slowly attained by fastening an oilstone slip to a flat piece of wood, or the flat side of a tool, and while bearing gently against the end of the rapidly revolving piece, move the slip in and out by the cross-feed screw.

The index should be turned out of a piece of steel, but brass will do and may be cast roughly to shape and then turned to size. Fit it to the taper of the spindle and counterbore for the screw in the end. When finished, lay off the divisions on the edge as follows:—Cut from a sheet of hard glazed writing paper, a strip $\frac{1}{8}$″ wide and wrap it around the circumference, cutting the ends so that they meet exactly without any overlapping or clearance. Now lay the strip on a drawing board and divide it into exactly twenty-five parts, making a light mark at each division. With a little patience each division may again be divided into ten parts, making two hundred and fifty divisions on the circumference. Now wrap the strip around the circumference again and fasten with a drop of glue or wax, allowing the edge to coincide with a fine line that was cut in the circumference while in the lathe. This will leave about $\frac{1}{8}$″ of clear metal exposed. Now coat this exposed surface with a little parafine or beeswax and when cold, scribe the divisions on the wax, being sure to cut completely through to the metal beneath. Make the 0, 5, 10, 15, 20 and 25 divisions extend from the line to edge, the other divisions being about half that length. If the smaller divisions are to be laid off, make them just a little shorter so that they will be distinct, the middle or fifth division being longer than the rest

When this marking on the wax has been completed, brush over the cuts with a camels hair brush charged with nitric acid. Be sure that the acid penetrates to the metal, otherwise the etching will not be clear. Before washing off the acid, feel the marks with the point of a needle to make sure that there is a depression there deep enough to prevent the needle point from slipping. When the divisions are etched plainly, wash off all the acid and wax, finishing by rubbing the cuts with oil to prevent rusting, which is one of

the troubles with freshly etched work.

To the stock *a*, attach the small scale which is made of No. 20 sheet brass. One inch is laid off on its edge in fortieths, every fourth division being made double length, dividing the inch into tenths. When this scale is attached, the circumferential line on the index wheel should coincide with the 0 division when the 0 division of the index coincides with the edge of the scale. Since the number of threads is forty per inch, each revolution of the index wheel will move the point *f* $\frac{1}{40}$″ and the index line will have advanced one division on the scale. Now if the index is moved a part of a revolution, say one division ($\frac{1}{25}$) the spindle will move $\frac{1}{25}$″ x $\frac{1}{40}$″ = 1-1000″.

To set the micrometer to measure distances from 1″ down, bring the stock *b* up until the two spindles touch and clamp in position. If after clamping the two points do not touch exactly, as indicated by the position of the index, loosen the screws binding *d* and push up until perfect contact is secured. Then pieces may be measured between the two points.

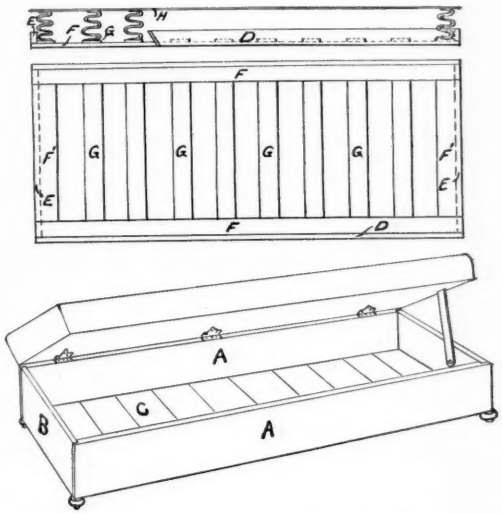
For measurements beyond an inch, standard blocks must be inserted between the points and the setting thus made. The making of a set of standard pieces is a very interesting and profitable undertaking. They may be turned nearly to size from $\frac{1}{4}$″ Stubb's steel and then hardened. They are finally ground to size by hand. A set consisting of 1″, 2″, 3″, 4″ and 5″ should be made for this micrometer.

# A SPRING BOX COUCH.

JOHN F. ADAMS.

The upholstered spring couch here described will be found very convenient, as the box base has ample capacity for the storage of bed clothes, and wash dresses and other clothing can be kept therein without folding, a feature greatly appreciated by ladies. It is easily made at small expense.

The frame work is made of pin poplar or chestnut. The sides *a*, of the box base are 6′ long 9″ wide and $\frac{7}{8}$″ thick, the ends and bottom inside edges being rabbeted to receive the end pieces *B* and sheathing for the bottom. The end pieces *B* are 29″ long and also rabbited for the bottom. The bottom *C* is $\frac{1}{2}$″ matched sheathing. The joints of the frame are glued and firmly nailed with wire nails, a few screws adding to the strength. Circular blocks, 3″ diameter and 1 $\frac{1}{2}$″ thick are screwed to each corner for receiving castors. The frame of the top should be firmly made. The side pieces *D*, are 6′ long, 2 $\frac{1}{2}$″ wide and $\frac{7}{8}$″ thick. The end pieces *E* are 28″ long, 1 $\frac{3}{8}$″ wide and $\frac{7}{8}$″ thick, the upper edges of *D* and *E* being flush, the joints being glued and firmly screwed. The pieces *F* are 6′ long, 2 $\frac{1}{2}$″ wide and $\frac{7}{8}$″ thick, and are firmly nailed to the inside lower edges of *D*. Similar pieces *F*′ 23″ long, and 4″ wide at the ends are nailed to the under edges of pieces *E*, and corner nailed to *F*, also glued at the ends to *F*, or a firmer joint secured by halving in which case these pieces are 28″ long.




To hold the springs, 10 strips *G*, 28″ long, 3″ wide and $\frac{1}{2}$″ thick are glued and screwed to the pieces *E*, one at each end, and the others spaced

7 ½″ between centres. A piece of $\frac{3}{16}$″ steel wire *H* is bent to the shape of the frame with round corners, the ends being lapped about 3″ and fastened by winding with wire after filing a few notches in the outer edges to prevent the ends from working apart. Four springs are fastened to each cross piece *G* making 40 springs in all, those on the ends being flush with the ends of pieces *G*, and the others spaced equally between them. The springs, which should be fairly heavy, are attached to pieces *G* with strong staples, and the tops laced with heavy manilla cord to hold them upright and prevent them from getting out of position or shape. The spring wire edge *H* is also firmly corded to the springs which it touches thus giving a firm yet flexible edge.

With the springs fastened as directed, a covering of heavy burlap or canvas is then put on, the springs being sewed to same with a few turns of upholstering twine. The edges are firmly tacked to the upper edges of the pieces *D*, not to the sides of same. A layer of hair, Florida moss, hemp or such other material as the maker may prefer, is evenly placed over the covering of the springs, using care to see that no bunches are left. The covering of corduroy or figured upholstering material as preferred, having been previously fitted and sewed, is then put on, the edges being tacked to the under edges of pieces *D*.

A corded edge adds to the appearance, this work being done on the sewing machine. The top width is about 31″ and the sides and ends 8″ allowing 1″ for turning under and tacking. The covering for the box base is 11″ wide, ¾″ on each edge being turned and tacked to top and bottom edges of *A* and *B*. If striped material is used, the stripes on the sides and ends should run lengthwise. The top is tufted by sewing between each row of springs, buttons covered with the same material as covering being used. The under side of the top and the inside of the box are covered with figured cotton goods, tacked with small upholstering tacks, the top being previously attached to the base with three T hinges. A special spring fixture is used by manufacturers of such couches, which by means of strong springs enables the top to be easily raised or lowered, and if obtainable, are desirable to use instead of hinges. If the latter are used, supporting sticks for holding up the top should be attached to each end with thick screws, as the weight of the top is considerable.

# A POWER DORY.

CARL H. CLARK.

## IV. THE DECK.

After the deck is laid and trimmed off, the top of the stern board should also be trimmed 3-4″ above the level of the deck, and to the same curve. The stem is cut off and shaped as shown in Fig. 2 with a 3-4″ hole bored to take a rope if desired. The face of the stem has been preferably left 3-4″ wide, and a piece of 3-4″ flat or half round galvanized iron or brass strip is bent around and fastened into place with screws. At the top it is carried up and around the curve, and the lower end extends a foot or so along the bottom.

The washboard *L*, Figs. 2 and 3, is of oak, about 6″ wide and 1-2″ thick. The stock for this should not be very dry, as it must be quite limber to bend sharply enough. It should be in two pieces, joined on the sides. A steam box, as before described, may be necessary for this purpose, as it must be thoroughly steamed. When bent into place it is fastened with screws. Before boring for the screws, a centrebore should be made about 1-4″ deep, and slightly larger than the head of the screw, so that the latter may lie below the surface. The counterbore is then filled with a plug or "bung" cut for this purpose across the grain, that it may be planed off smooth. These plugs are obtainable from any dealer in boat supplies in even sizes. They are set in lead paint and then trimmed down to the surface of the board.

The two parts of the washboard are to be joined by a piece about 8″ long put on the outside, the ends of the two parts being screwed to it. A rowlock socket is afterwards fitted on the top of the joint, to enable the use of oars when desired.

It is desirable that the deck should be covered with canvas, as it makes smoother work, and is easier to keep in good condition. Canvas for this purpose

should be about 8 oz. weight, in one width if possible, or it may be in two widths, lapped in the centre. It is cut about to the shape of the deck and washboard, leaving some for trimming. The deck is smeared with lead or thick paint, and the canvas laid on, drawn tight against the washboard and over the edge of the deck and tacked. A piece of about 3-8″ quarter round moulding is then fitted in the corner between the washboard and deck and the canvas trimmed off at its upper edge. This makes a good water tight joint. The outer edge is covered with a half round moulding about 1 1-4″ wide, which should be left bright and later varnished. Around the stem and across the stern the edge of the canvas is turned under and neatly tacked.

The skeg *O*, *P*, Fig. 2, is of hard wood 3 1-2″ thick, shaped as shown, the after edge of *P* is to be square with the line of the shaft. They are joined together diagonally as shown and nailed. The size of the skeg as shown, is sufficient for ordinary work, but for some uses it may be desirable to increase its size. If this is desired, the length may be increased, but should not be longer than half the length of the bottom. It is fastened to the bottom with 3-8″ rivets.

The flooring is laid directly upon the moulds and is 3-4″ thick; on the top of the cleats already in place between the moulds a strip is nailed to support the flooring between the moulds. It will be best to fit it now but not fasten it in place until the engine is installed. The middle board should be left loose to allow access to the space underneath. It will be well to fit a narrow piece at the outer edges of the floor extending diagonally down to the planking to keep articles from rolling down under the floor.

Seats are to be fitted as shown in Figs. 1, 2, 3, about 15″ above the floor. They are supported on short braces fastened to the moulds and an upright under the outer end. The seats may be notched around the moulds and extend out to the plank, or they may run along on the inside of the moulds with a narrow strip along the back to prevent articles from rolling behind.

The space under the seats may be left open, in which case turned uprights should be used under the seats, or if desired, sheathing may be carried as shown in Fig 3, and doors fitted to give access; this gives valuable storage space. Before fitting the bulkhead forward, the fuel tank is to be put into place.

If a complete outfit is purchased the fuel tank is a part of it, and all that is necessary is to fasten it into place. If however, it should be necessary to have a tank made, it should be about 10 or 12 gallons capacity, and of copper or galvanized iron, riveted and soldered; too much care cannot be taken to make this tank absolutely tight, as any leak will cause great danger to boat and occupants. A round tank is most easily made, and one 12″ diameter and 20″ long will hold about 10 gallons. The tank must be kept as high as possible, and if greater capacity is desired, a flat tank should be used.

The dimensions of the latter can be taken from the boat. It is suggested however, that a tank 18″ long, 24″ across the after end, 12″ across the forward end and 8″ deep will be of about the proper size. It should be arranged to fit closely up under the deck and the filling pipe should be arranged to extend up to the deck so as to leave no open space, and should have a screw cap with a small hole in it.

The opening in the deck can be covered with a brass cap of some sort. The outlet from the tank should be a plug cock with a union on it and should be strongly soldered to the tank. When the tank has been fitted into place it is supported by cross braces and must be blocked so as to prevent it from shifting as the boat rolls. It has been suggested to the writer that, since leakage of gasoline is such a dangerous matter it would be well to line the space under the tank with lead or zinc, or make a tray which would fit under the tank, and thus catch any possible drippings and prevent its running aft to the motor, where it might become ignited. The arrangement just outlined for the interior is merely suggestive, and any other desired arrangement may be carried out equally well.

The bulkhead is of 5-8″ tongued and grooved sheathing, and is nailed at its upper edge to a strip nailed on the under side of the deck beam; cleats are fastened to the plank to take the lower ends of the boards. The boards should be shaped to fit to the plank as closely as possible and make a neat joint. An opening should be left, and fitted with a hinged door, as the space is valuable for storage. There will also be a bulkhead at the after end of the standing room, but it cannot be fitted until after the engine has been installed.

The rudder and skeg are of metal, the plate is about 3-16″ or 14″ thick, about 15″ wide and 19″ deep, cut to the shape of Fig. 2. The stock is 1″ diameter, and of the proper length measured from the boat. It will be best to have a blacksmith get out the stock as it requires to be heated and split to allow the insertion of the plate; holes are then drilled and the two riveted together. The lower end has a 1-4″ hole for a split pin and the upper end is squared and has a 1-4″ hole through also; the square part being about 1″ long.

The skeg is of flat iron 2″ x 1-2″ shaped from the boat, the end being bent over as in Fig. 2 and bored to fit the lower end of the rudder stock. Both skeg and rudder ought to be galvanized if for use in salt water.

A cheaper way of making the rudder, although not as good is to use a piece of 1″ gas pipe for the stock; which is drilled with several 3-8″ holes. The body of the rudder is made up of 1″ stock which is bored with 3-8″ holes to correspond; iron rods are then driven through all and the ends headed over. The lower end has a piece of rod welded or riveted in with the 1-4″ hole before mentioned, and the upper end has a 3-8″ hole for a pin through the tiller. This makes a very good rudder if well made, and is much cheaper

than the other, and easier to make. The sleeve shown is put in to make a tight joint where the stock goes through the stern board. It is a piece of pipe about 8″ long, a loose fit for the rudder stock and preferably threaded. The tiller should be about 18″ long, with a square hole to fit the top of the rudder stock and a hole in the small end for the wheel ropes. It may be cast from a rough pattern, the hole drilled and then filed square, or it may be purchased from a dealer in launch outfits.

In setting the rudder in place the sleeve is first set by boring through the stern board. In order to bore at the required angle a piece of board can be nailed both inside and outside; to enable the bit to be started square. The sleeve is then screwed into place and the outside block split off; the inside one would best be left to steady the sleeve. It should be so adjusted that the tiller will rest on the top of the sleeve with a washer between and take the weight of the rudder. The tiller should be a close fit on the square end of the rudder, and a pin put through the hole above the tiller. The skeg is so shaped and adjusted that it supports the rudder and allows it to swing freely. The rudder should not be put in place permanently until after the engine has been installed. A locker is to be constructed on each side of the engine, about a foot wide, and at about the height of the seats. One of these will accommodate the batteries, spark coil, etc., and the other can be used for tools, etc.

The steering wheel can be placed either in the forward end of the standing room or on the side, just forward of the engine, or, if desired, two may be used. The wheel is fitted with a drum about 4″ diameter and 5″ long and can be purchased complete if desired.

Pulleys are fastened to each side of the boat just opposite the wheel, and about 3″ aft of the hole in the tiller, to take the tiller ropes. For these ropes either a small wire rope or braided line can be used. Holes are bored in the tops of the moulds just large enough to allow it to pass. Four or five turns are taken around the wheel, and the ends made fast to the hole in the tiller. A very simple arrangement is a lever pivoted vertically just forward of the engine and extending about 8″ above the wash rail; the steering ropes are connected to it and by moving it forward or back the rudder is controlled.

The hole for the shaft can be bored about 1 1-4″ diameter. It must line up with the bed and be in the middle of the deadwood *P*. Specific directions can hardly be given for this work, but it will probably be well to bore from the outside, making first only a small hole. By drawing a wire through the hole and stretching the end out over the bed, the direction can be noted and any change in direction made in boring the full sized hole. If the hole does not come quite right it may be trimmed out on the inside end with a gouge.

A large heavy cleat, either of galvanized iron or wood should be fastened on the forward deck with bolts, for making fast the mooring line, and a similar one on the after deck for towing and similar uses. These cleats should point fore and aft, and should be strongly bolted to the beams. It is also a good idea to fit under the corner of each plank for the space of about 10′, amidships, a piece of quarter round moulding. This protects the corners of the plank, and presents a rather evener surface.

The hull is to be smoothed down with sandpaper, all nail holes and cracks filled with putty and painted with two coats inside and three outside. The wash rail and other bright parts are covered with two coats of best spar varnish. If for use in salt water, the bottom up to about 2″ above the water line should be covered with some form of anti-fouling preparation. The last coat of paint should not be put on until the engine has been installed and the boat is ready for the water.

These directions are supposed to complete the construction of the hull, except so far as the individual builder sees fit to arrange for himself. The installation and fitting out of the engine will be described in the next and last chapter.

NOTE — For the convenience of those who may wish to purchase their engine in the fall, and thus take advantage of lower prices then prevailing, the writer would say that the power recommended is about 2 or 2 1-2 H. P. A 1 1-2 H. P. engine can be used if high speed is not desired, but a 2 or 2 1-2 H. P will be found to be better in every way. In case a 2 1-2 H. P. size is not obtainable in the make desired, a 3 H. P. engine will not be out of place, and will make a very powerful boat. As many manufacturers rate the capacity of their engines differently, purchaser will be obliged to consider the dimensions of engines when making comparisons of power.

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Prof. Nikolaus Artemieff, of Kien, Russia, invented some time ago a protecting suit, consisting of an overall, with sleeves, gloves, headgear and so on, and made up of fine copper wire, interwoven in cloth, the idea being to protect the human body from dangerous currents by short circuiting with the copper. Such protecting suits, according to the Electrician of London, are now being put upon the market by Messrs Siemens & Halske, in Germany. They are said to be so dimensionized that a current of 200 amperes may flow continuously through the protection without producing undue heat, and a current of 600 amperes for a few seconds without injuring the operator.

In actual tests made with a 20 kilowatt, 150,000 volt transformer, it is stated that any two points at this pressure could be short-circuited by the operator without any injury to the body whatever. In touching two points of different potential no contraction of the muscles took place. The resistance of the protecting suit, measured from hand to hand, is stated to be 0.01 ohm, so that 1000 amperes would produce a potential difference of 10 volts.

# PRINTING FOR BEGINNERS.

FREDERICK A. DRAPER.

## I. INTRODUCTORY.

While much has been written upon this important subject, and many books are available for those who desire to make a study of it, yet it is the belief of the writer that these books are designed for those who are persuing their work in fully equipped printing establishments. It is thought therefore, that this series of articles, prepared especially for those totally unacquainted with the work and lacking the guidance of experienced workman close at hand, will be found interesting and valuable, especially to those who desire to begin in a small way, extending their field of work as experience is acquired. For this reason, special prominence will be given to the many small economies which, in a small shop, are both desirable and necessary for the production of work at a profit, and without heavy expense for materials.

To the one making a start with a shop of his own, the question of an outfit is a most important one, for unless a well filled pocket book can be drawn upon, the expense for bare necessities will seem comparatively large, and the range of available work, extremly limited. For this reason, it might be well to give attention to the various kinds of work which are within the capacity of a small shop, and to the ways, in which a small beginning can be built up without excessive cost. Most careful thought must be given to selecting the necessary type and materials, so that everything obtained shall be usable to the fullest extent. The catalogs of the large dealers in printers' supplies are so attractive that the novice will succumb to the alluring inducements of new and attractive faces of type, labor saving machines, etc., and soon find himself stocked with much unproductive equipment, which more care and thought would have avoided.

Keeping this in mind, the first consideration is the fields of profitable work open to a beginner with a small shop; the requirements of the amateur who would print a small paper "for fun," will also receive attention. It hardly needs mention that the printing business as with any other, requires a location where the desired nnmber of customers can be secured, the ability to secure them depending upon the personal popularity, financial and mechanical skill of the printer, and capacity of the shop. Assuming that these are sufficiently promising to warrant a start, what shall be the lines of business to be solicited and for doing which the shop is equipped?

In answering this question it will be assumed that, on the score of expense, a special line of work is first to be undertaken, ways for subsequent development being given, and utilized as local conditions may warrant. Among the several lines included in these conditions, is that of visiting and business cards. Acceptable work of this kind can be done with a small assortment of type, a small press and few accessories; the profits average greater than in most lines, and business can be more easily obtained. This is especially true if the location is in a large city where conventions are numerous. A young amateur of the writer's acquaintance, makes a specialty of visiting the first sessions of conventions held in the city where he resides, interviewing the delegates, many of whom are unprovided with cards, and as quick delivery is promised receives numerous orders, at very profitable prices. With such orders, the style is nearly uniform and the work quickly done. A stock of blank cards of suitable size is kept on hand, and time is economized to the best advantage to turn out quickly the maximum amount of work. Should a reader not be so fortunately situated, a canvas among the professional and business men of any large town or city, will find many without cards, and willing to give an order to any bright young man who attractively presents his business. Closely associated with this line is that of admission tickets for entertainments, programes for same, and dance orders, invitations, milinery openings, postal card announcements, etc., which can be broadened to include bill and letter heads, statements, envelopes, blotters, etc. These lines are selected as the paper and card stock can be purchased of paper dealers cut to size, thus dispensing with the use of paper and card cutters, both expensive machines, the purchase of which is warranted only by a business exceeding the capacity of what is here termed a "small" shop.

We will now consider the appliances necessary to a proper production of the work above mentioned, giving first attention to the press, as the type, furniture, ornaments, etc., are in a measure selected to conform to the limitations of work which may be done upon the press. Good work demands a good press; a poor one means that the business is handicaped at the outset by difficulties which more than offset the saving in first cost, and limit both the capacity and quality of the work. On no account buy a small toy press, requiring short type.

In obtaining a press, the opportunities offered by dealers in second hand presses should not be overlooked, but the advice of an experienced pressman

should be secured, if possible, when making the purchase of either an old or a new press, as there are many things entering into the design and operation much can only be learned by long experience, and the novice would be quite likely to select a press poorly suited to his needs. An advertisement in the nearest newspaper of large circulation will often bring a favorable offer from some one having a press for sale. Inquiries can also be made of employees in neighboring printing establishments. In purchasing a second hand press, the wear of shafts and bearings, should be carefully ascertained; if badly worn good work cannot be done upon it. If parts have been repaired, learn if sufficient strength has been secured by the repairs, so that an early break down is not probable. A broken part in a press materially reduces its selling value, even if the break has been well repaired.

If possible, secure a foot power press, the increased speed and convenience of operation, soon returning the extra cost over a hand lever press. With the former, a "throw off" is desirable, this being a lever for throwing off the platen, when desired, so that the type will not come in contact with it. This will be more fully explained when the subject of "Presswork" is reached. The hand lever press does not require a "throw off" the movement of the platen being controlled by the lever. While preference should be given to the foot power press, a wide variety of excellent work can be done with a hand lever press of good design. Whether foot or hand power, it should be self-inking, as hand inking presses require considerable care and skill to secure a proper inking of the type, as well as more time for the work; two operations, that of inking and feeding the paper, being necessary for each impression. For plain card work a hand inking press will answer, but the beginner will find it a difficult matter to do acceptable work with it.

The size is also important. Presses are designated by the size of the chase, the iron frame which holds the type. Even if only card work is to be done, a chase 5 x 8 inches, inside measurement, is desirable, as 3-4 inch each way is necessary for the "lock up," that is, the fastening quoins, usually metal, holding the type firmly in the chase. A press with a chase 6 x 9 inches costs but little more than the other and will print full size letter heads. Other desirable sizes are 6 x 10 and 7 x 11 inches, the greater capacity being desirable if within the means of the reader. The design and construction of the many good presses sold by dealers will not here be touched upon, these being matters about which the purchaser should consult with an experienced friend. Most printers will gladly give reliable advice upon this subject to a worthy inquirer.

A desirable feature found on most presses now manufactured is that of the regulation of the platen by means of impression screws. Without such screws the "make ready," or preparation of the platen to obtain an even ink impression, is entirely secured by "overlaying" or "under laying," the former being the addition or removal of varying thickness of paper to the platen, and the latter, the addition of paper or thin cardboard strips to such cuts and worn type as may be necessary to raise them to a level with the rest of the type. This work is still necessary, even with a platen fitted with impression screws, as these screws should be adjusted only when absolutely required by extra thin or thick stock, or large uneven "cuts," this being the general term for designating electrotypes, process plates, etc.

# HAND - SAWS.

## THEIR CONSTRUCTION AND USE.

EXTRACTS FROM "HANDBOOK FOR LUMBERMEN," HENRY DISSTON & SONS.

The demand for an article of instruction on saw filing having been demonstrated to us not only by personal inquiry and letter, but also by the return of fine quality saws, pronounced defective through a lack of knowledge of how to keep them in order, or by the use of extensively advertised so-called saw sets and other tools,—which pull the saw blade apart or so distort it as to render it unfit for use—has led us to compile this information for the enlightenment of the amateur, and the improvement of the expert mechanic.

We will endeavor to give such practical information as to the proper methods of keeping saws in order and of the tools with which to do so, that will overcome the above-mentioned pitfalls to the proper working of the saw.

The following cuts give the full size of the respective number of teeth and points per inch which they represent. Care should be taken when ordering to specify whether teeth or points per inch are intended, for it will be noticed that in one inch space there is one tooth less than there are points.

### PRINCIPLE OF CONSTRUCTION.

The saw is either reciprocating or continuous in action, the first being a flat blade and practically straight edge, making a plane cut, as in hand, mill, jig and sash saws; the latter, either a circular or rotating

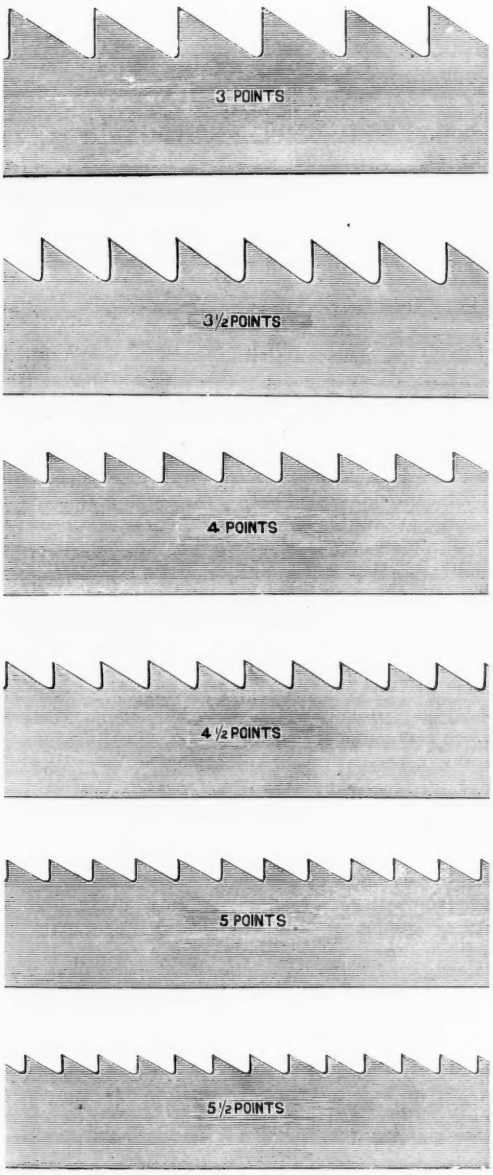



FIG. 1. RIP SAWS.

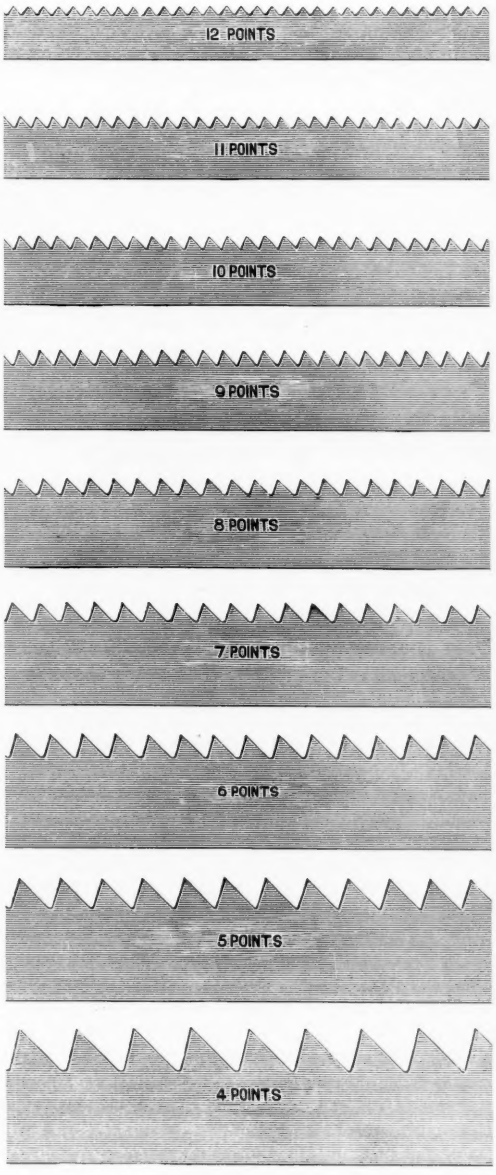



FIG. 2. CROSS-CUT SAWS.

disc, cutting in a plane at a right angle to its axis, a cylindrical or barrel shape with a convex edge cutting parallel to its axis, or a continuons ribbon or band running on two pullews making a plain or curved cut with a straight edge parallel to their axis of rotation. Practically speaking, the teeth are a series of knives set on a circular or straight line, each tooth cutting out its proportion of wood and prevented from cutting more by the teeth on either side of it. Each tooth should cut the same amount and carry out the chip or dust, dropping it below the material being sawed. Different kinds of wood require teeth varying in number, angle or pitch and style of filing.

The perfection of a saw is one that cuts the fastest

and smoothest with the least expenditure of power; to do this, it is evident that each tooth should be so constructed and dressed as to do on equal proportion of the work, for if any of the teeth are out of line or shape, they are not only useless themselves, but a disadvantage to the others. We find many good mechanics who frankly acknowledge that they never could file a saw satisfactorily; the probable reason is that they never studied the principle of the action or working of the tool. There is no reason why any man of ordinary mechanical ability should not be able to file, and keep his saw in order, but like all trades, it requires practice and study of the subject.

The following illustrations and explanations will greatly assist in the selection of a saw and show the best methods of keeping it in order. These should be carefully studied.

A saw tooth has two functions—paring and scraping. A slitting or ripping saw for wood should have its cutting edge at about right angles to the fibre of the wood, severing it in *one* place, the throat of tooth wedging out the piece.

In a cross-cut wood saw, the cutting edge also strikes the fibre at right angles to its length, but severs it on *each side* from the main body before dislodging it.

### Rip Saws.

Fig. 1 is a four-point rip or slitting saw with the rake all in front, where the cutting duty is. This saw should be filed square across, filing one-half the teeth from each side after setting, which will give a slight bevel to the cutting edge of tooth, as it should be for soft wood; for medium hard woods a finer toothed saw with five points to the inch should be used and dressed in the same manner; for the very hardest and toughest cross-grained woods a still finer tooth saw is required, with the teeth filed slightly beveling, as ripping cross-grained stuff partakes a little of the nature of cross-cutting. In all cases where ripping is done, the thrust of the saw should be on an angle of about 45° to the material being cut, as shown in Fig. 2, this makes a shearing cut, an advantage that can be quickly demonstrated with an ordinary pocket knife cutting any piece of wood. For ripping thoroughly dry lumber, it will be found advantageous to use an extra thin back saw which will run without set.

### Cross Cut Hand-Saws.

In cross-cutting, the fibre of the wood is severed *twice*—on each side of the saw—the thrust dislodging and carrying the dust out.

Fig. 3 is a five-point peg tooth cross-cut saw with the rake on the side. For the same reason that the rip saw has the rake on front of tooth, the cross-cut has it on side, as that is where the cutting duty is. The bevel or fleam to teeth in Fig. 3 is about 45°, while there is no pitch at all; the angle on each side being the same, forms the "*peg tooth*," which is best adapted to cutting soft, wet and fibrous woods. This style of tooth is principally used in buck-saws.

In all cases, the size and length of teeth depend largely upon the duty required; a long tooth has the demerit of being weak and liable to spring, but the merit of giving a greater clearance to the saw-dust. The throat space in front of each tooth must be large enough to contain the dust of that tooth from one stroke; the greater the feed, the deeper the dust chamber required, or, more teeth.

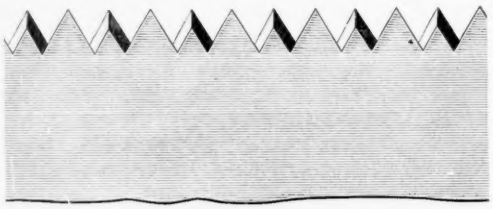


Fig. 3. Peg Tooth Cross-Cut Saw.

The first point to be observed in the selection of a saw is to see that it "hangs" right. Grasp it by the handle and hold it in position for woreing, to see if the handle fits the hand properly. These are points of great importance ior comfort and utility. A handle should be symmetrical, and the lines as perfect as any drawing. Handles made of green wood soon shrink and become loose, the screws standing above the wood. An unseasoned handle is liable to warp and throw the saw out of shape. The next thing in order is to try blade by springing it, seeing that it bends regularly and evenly from point to butt in proportion as the width and gauge of the saw varies. If the blade is too heavy in comparison to the teeth, the saw will never give satisfaction, because it will require more labor to use it; the thinner you can get a stiff saw the better; it makes less kerf and takes less muscle to drive it. This principle applies to the well-ground saw. There is less friction on a narrow true saw than on a wide one; you will get a smaller portion of blade, but you will save much unnecessary labor at a very little loss of the width.

See that it is well set and sharpened, and has a good crowning breast; place it at a distance from you and get a proper light on it, by which you can see if there is any imperfection in grinding or hammering. We should invariably make a cut before purchasing a saw, even if we had to carry a board to the hardware store. We set our saws on a stake or small anvil with a hammer; a highly tempered saw takes three or four blows, as it is apt to break by attempting to set it with but one blow. This is a severe test, and no tooth ought to break afterwards in setting, nor will it, if the mechanic adopts the proper method. The saw that is easily filed and set is easily made dull. We have frequent complaints about hard saws, though they are not as hard as we would make them if we dared; but we shall never be able to introduce a harder saw until the mechanic is educated to a more correct method of setting it. As a rule, saws are given more set than is neces-

sary, and if more attention was paid to keeping points well sharpened, any well-made saw would run with very little set, and there would be fewer broken ones. The principal trouble is that too many try to get part of the set out of the body of the plate, whereas the whole of the set should be on the teeth. Setting below the root of the tooth distorts and strains the saw-plate, which may cause a full tempered cast-steel blade to crack, and eventually break at this spot; and it is always an injury to the saw, even if it does not crack.

# JUNIOR DEPARTMENT

**For the Instruction and Information of Younger Readers.**

## MODEL " RELIANCE ".

This model is designed as a companion to the Shamrock III model in the last issue. The general directions for making the latter model apply to this one equally well. The dimensions of Fig. 1 are as follows:

| | |
|---|---|
| Length on L. W. L. | 30″ |
| Overhang forward | 9 1-4″ |
| ,, aft | 7 5-8″ |
| Height of Sheer at stem | 2 7-8″ |
| ,, ,, ,, ,, taf.ail | 2″ |
| ,, ,, ,, ,, lowest point | 1 5-8″ |
| Greatest width on deck | 9″ |
| Width at tafrail | 2 1-2″ |
| Greatest draft | 6 1-4″ |

If the model is built for sailing it should be hollowed out to about 1-2″ in thickness. The neatest way to fit the board for the deck, is to cut it about 1-4″ smaller all around than the outline of the boat, then with a sharp knife mark around it and cut down with a chisel deep enough to allow the board to set down flush with the outside edge of the deck. This board is about 1-8″ thick.

The amount of ballast which the boat will carry cannot be determined until the hull is hollowed out. It may then be floated in water, and sufficient lead put on board to bring her nearly down to the waterline, this amount is then melted and moulded into the keel, which is fastened on with long screws, or small brass bolts, A small amount must be left to fasten inside to bring her to just the proper trim.

The lines as shown are rather fuller than in the actual boat, but this is necessary for a sailing model to enable her to carry her sail successfully. The spars are of straight grained spruce.

The sail plan as shown in Fig. 2 is drawn to scale and the lengths of the several lines can be scaled directly. The mast is placed 18″ back from the stem; it is 45″ long above the deck, 3-4″ diameter from deck to above the gaff, tapering to 1-4″ at top. The boom is about 33″ long, 3-8″ diameter at each end, 5-8″ diameter at the main sheet fastening, tapering towards the ends. The gaff is 20″ long, and about 1-2″ thick, with slightly oval shape; it should be fitted with a pair of jaws to fit against the mast, either of wood, or sheet brass bent to shape and tacked on. The bowsprit is 10″ long outboard; and about, 5-8″ diameter, tapering to 3-8″ at the outer end. It is fastened to the deck by small straps of brass bent over it and screwed to the deck.

It is recommended that for the rigging fine brass wire be used. For the mast there should be three side stays, two leading from the point of attachment of the fore stay, and one from the topmast head; leading down to chain plates about 3-4″ apart, which are made of narrow brass fastened to the hull with brass nails or screws. A very neat way of making these stays fast is to turn a loop about 1-8″ diameter, so that it stands about 1-2″ above the chain plates, then several strands of silk line are rove through both, making a good finish. At the top a loop is turned to fit over the mast and bear upon the head of a small screw or nail, to prevent slipping down. The forward stays are fastened by loops in the same manner, and are adjusted to the proper length and the slack taken out by lightening the side stays. The topmast stay leads out over a pair of spreaders about 10″ long, which can be made by soldering a piece of wire on each side of a band and bringing the ends together and forming an eye for the stay, as in Fig. 3.

The bobstay is made of rather heavier wire and may well be double; its lower end is fastened to a brass strap. The bowsprit also has a side stay on each side, kept apart by a spreader of wire passing through the hull just aft of the stem. An eye in the end of the boom takes a corresponding eye in the mast and allows the boom to swing. To attach the main sheet, a small band of wire may be made around the boom.

The rudder has a metal stock 1-8″ diameter, passing through a tube to make it water tight. It must be an easy fit and turn readily. The steering gear is as shown in Fig. 3. The double ended tiller is on the rudder head, pointing fore and aft; the aftermost eye takes the main sheet and the forward eye takes one end of a spiral spring. To the other end of the spring is attached the screw, about 1-8″ diameter, which passes through the stop on the deck, and has a thumb nut by which the spring is extended more or less. In sailing, the rudder will be turned an amount varying with the pressure of the wind, and the amount of turn

Fig. 3.



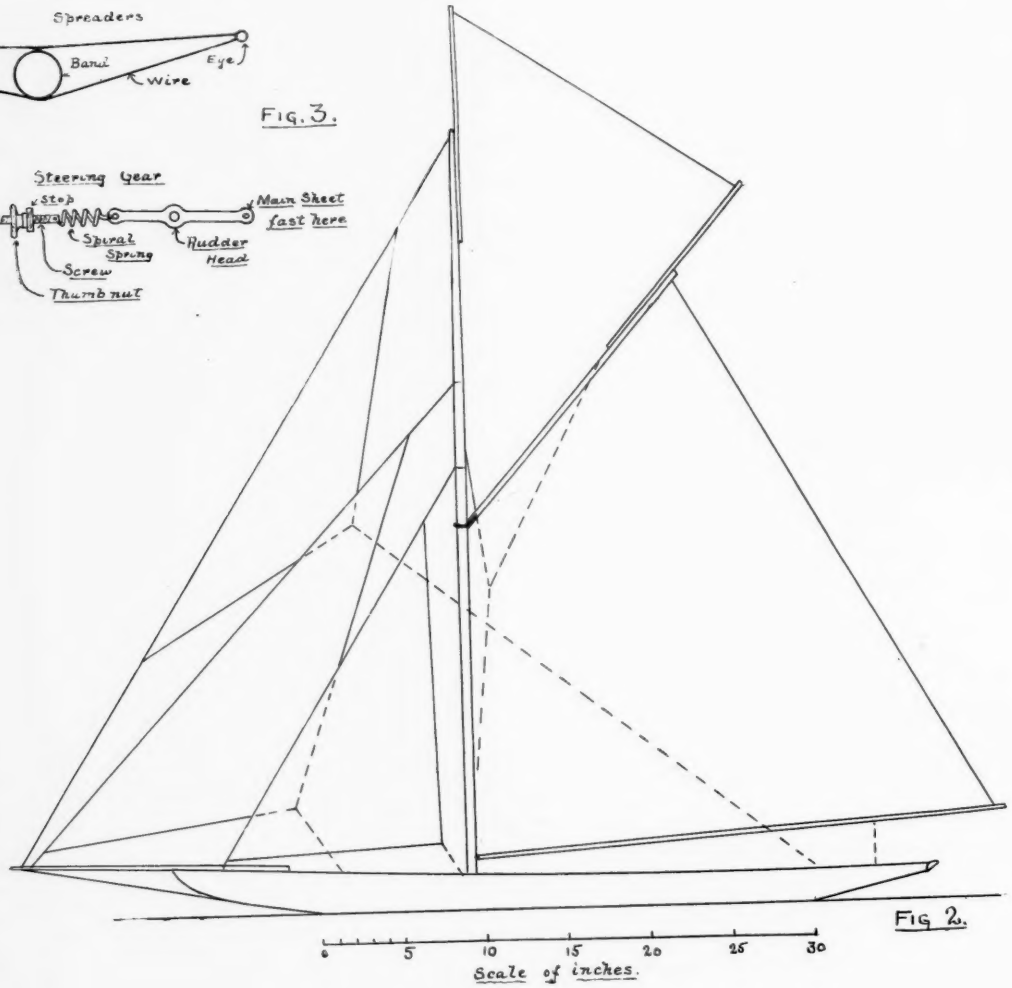
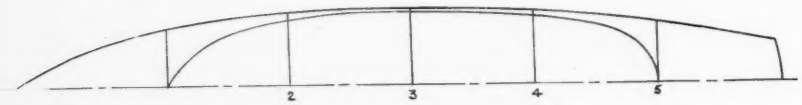
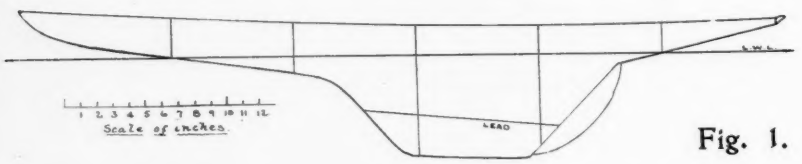




Fig 2.



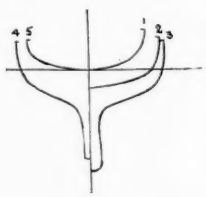




Fig. 1.

is regulated by the thumb nut. Definite dimensions cannot be given for these parts, as they depend upon the peculiarities of each boat, and can only be found by trial. This arrangement works very nicely when correctly adjusted.

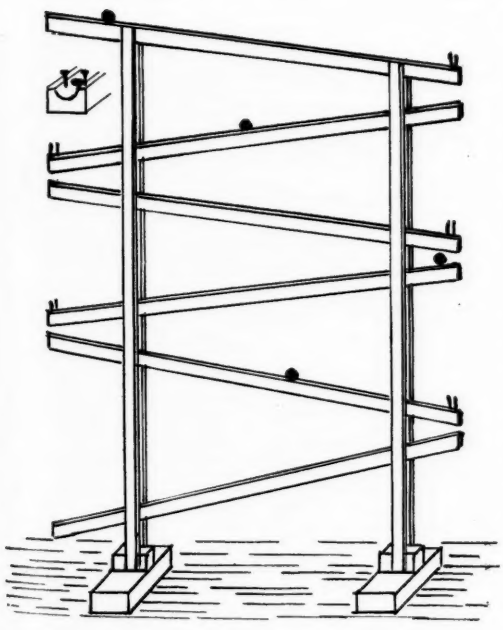
The sails are of light cotton cloth, or still better, of linen. The after edges of mainsail should be selvage edges and the other edges of all the sails should be neatly hemmed . The mainsail has rings which slide on the mast and is laced to boom and gaff. The stay- and jib are laced to the stays, and held up by halliards. while the club topsail and jib topsail are removable, The halliards for all the sails are fastened to small wire rings bent around the mast.

The mainsail will, of course adjust itself from side to side, but the head sails must be shifted when tacking, so chat a sheet is necessary on each side, leading around the fore stays, the leeward one being tightened. The sheets may be of small woven fish line and should lead through small staples driven into the deck far enough to cause an easy friction on the line and hold it at any point.

The rigging as outlined is for a model for sailing; if one is wanted for exhibition it can be made more ornamental, with blocks more pretentious rigging according to the desires and skill of the builder.

## MARBLE COASTER.

KENNETH G. ROBINSON.



The reader of this department who may have a youthful brother or sister for whom he would construct a pleasing toy, will find this marble coaster well worth the making. The six run ways are made of straight grained pieces of wood 18″ long, 1 1-2″ wide, and 7-8″ thick. A grooved is cut along the centre with a 3-4″ half round plane or gouge, and a 1″ hole bored 1-2″ from one end and at a slight angle so that the hole will be vertical when in position.

The upright pieces holding the runs are 1″ wide and 1-2″ thick, the longer ones being 22″ and the others 20″ long. These are nailed to each side of the runs with short wire nails, the bottom ends being nailed to small blocks 3″ x 1 1-2″ which in turn are nailed to larger blocks 5″ x 2″ x 7-8″ set crosswise as shown to hold the roller firmly upright. Nails are driven into the ends of each run just below the holes to stop the marbles, and cause them to drop through the holes into the run below. A small box at the end of the lower run catches them at that point. Small children will find much pleasure in placing the marbles in the top run and watching them roll back and forth to the bottom.

## HANDY RECEIPTS.

### HOUSEHOLD PASTE.

A strong, clean, lasting paste which will not sour, may be made in the following manner: — Into a double boiler or other suitable vessel, put three pints of flour, gradually adding about one quart of cold water, to make it the consistency of thick cream. Beat with an egg beater to free from lumps. Add one teaspoonful of powdered resin; beat again thoroughly. Cook over boiling water, having added one cup of boiling water to the mixture, stir constantly until thick. After cooling add one-fourth teaspoonful oil of cloves. Store in glass jars, and thin with warm water as needed for use. This will make about three pints of thick paste which will keep indefinitely.

### INK FOR RUBBER STAMPS.

The vehicle used in the preparation of inks for rubber stamps is glycerine, a non-drying substance, so that pads charged with the color may remain indefinitely. Such ink, of course, is not as desirable as one that would thoroughly dry on exposure; but the latter, regular printing ink, requires a kind of handling too troublesome for most users of stamps. Alinine colors are usually employed as the tinting agents. The following is a typical formula, the product being a black ink. Nigrosin 3 parts, water 15 parts, alcohol 15 parts, glycerine 70 parts. Dissolve the nigrosin in the alcohol, add the glycerine previously mixed with water, and rub well togther. *Druggist' Circular and Chemist' Gazette.*

SHOE BLACKING.

A good liquid blacking may be made by mixing 3 lb. of lampblack with 1 quart stale ale, and 1-2 pint sweet oil, adding thereto 1 oz. molasses, 1-4 oz green copperas, and 1-4″ oz. logwood extract. This blacking polishes easily and well.

STRONG MUCILAGE.

Equal parts of powdered gum tragacanth and gum arabic, moistened with diluted acetic acid, or if the color is not of importance with ordinary vinegar, will produce a strong mucilage which will keep well.

## CORRESPONDENCE.

Our readers are invited to contribute to this department, but no responsibility is assumed for the opinions expressed in these communications.

Illustrate the subject when possible by a drawing or photograph with dimensions.

Letters for this department should be addressed to editor of AMATEUR WORK, 77 Kilby St. Boston. They should be plainly written on only one side of the paper, with a top margin of one inch and side margins of one-half inch.

The name and address of the writer must be given, but will not be used, if so requested.

Enclose stamps, if direct answer is desired.

In referring to other letters, give the number of the letter referred to, and the date published.

Readers who desire to purchase articles not advertised in our colums will be furnished the addresses of dealers or manufacturers, if stamp is enclosed with request.

No. 62. KALAMAZOO, MICH. Sept. 26, '03.

There is one point about the closed-circuit cell described in the July, '03, number, which bothers me. When the Caustic Potash solution is put into the inside of the wire gauge cylinder it will leak through the gauge and mix with the filings. Is this detrimental to the cell or not?

R. H. W,

It is necessary that the electrolyte Caustic Potash solution reach the iron filings, otherwise there would be but little action.

No. 63. EVANSTON, ILL. Oct. 8, 1903.

I am building a canoe after the model described in the April number of AMATEUR WORK, and would like information on a point which does not seem quite clear to me. Are the longitudinal strips to which the ribs are bent, intended to be removed before putting on the sheathing?

P. B.

The long ribbands are to be removed before putting on the sheathing of the canoe. They are used simply as guides for setting up the ribs to the correct lines, this being an easy yet satisfactory way for doing this part of the work.

No. 64. MONTEREY, CAL. Oct. 12, 1903.

Will you please tell me of a book giving the best instruction on the operation and construction of Gas or Gasoline engines. And also please state what is the best book on the Steam engine for a beginner.

C. F.

A good book on the Steam engine is by Ripper, Gas and Gasoline Engines, Roberts Gas Engine Handbook. A series of articles on the subject of "Gas Engines" will begin in the next issue of this magazine.

No. 65. PITTSFIELD, MASS. Oct. 14, '03.

I have a few questions I wish you would be kind enough to answer in your correspondence column. I have made the Wimshurst machine described in your paper a year ago last spring, and think it a success. Very often I draw a spark almost five inches long. I think I will make the large Wimshurst machine described some time ago and the mercury air pump described a few months ago if you think I could make a X-ray outfit? A. Would the expense be great besides the air-pump and large static machine? B. If possible could you publish an article on the X-rays. C. What is the amperage of the bichromate plunge battery described in No. 7 of Vol II with the cells in series if the voltage is 12.6. D How long will the electrolyte last? E Will it run the motor described in No. 5 of Vol. I at its full capacity?

I also got the idea of a gramaphone from your paper, I did not follow the exact lines on the sound-box or case but the clearness and volume of sound is about as good as I have ever heard on the best of machines.

W. G.

A. The question is not very explicit. The expense of an X-ray outfit, except the tube, is small.

B. An article onX-ray work will be published in the near future.

C. 4. 2 amperes.

D. The electrolyte should last at least 100 ampere hours on closed circuit, but depends to a considerable extent upon the quality of the materials used in its construction.

4. This battery is more than sufficient to run the motor mentioned; one of three cells being quite adequate.

No. 66 MINCO, I. T. Oct. 18, '03.

A. I wish to know why a gravity battery will not run an electric motor? B. Can you tell me of any book on electrical construction, the price, and where it can be purchased.

M. B. W.

A. A gravity battery will run a motor if a sufficient number of cells are emyloyed. The chief difficulty with this type of cell is the high internal resistance, and since they have an E.M. F. of only 1 volt, the amount of current is necessarily very small from one cell. A battery of 10 of these cells should be sufficient to supply the necessary current for operating small motors. Their chief advantage lies in their constancy.

B. It will be necessary to know more definitely the kind of constructive electrical work in which you are interested, before this question can be answered.

No. 67. LYNN, MASS, Oct. 3, 1903.

I would like to make a jump spark coil for a 3 H. P. engine. Can you give me information relating to the winding of the secondary coil.

J. M. H.

A description of a spark coil for engines of about the size you mention is in preparation and will be published, if ready, in the next number of this magazine.

## TRADE NOTES

In response to the frequent demands for Yankee Screw Drivers put up in substantial and well finished boxes to be used by amateur mechanics who desire to keep their tools in fine order, and gentlemen who appreciate handsome tools, the North Bros. Mfg. Co. of Philadelphia, Pa., have prepared such a set in a box which is very substantially made of oak and handsomely finished. The box contains one each of No. 30 spiral ratchet screw driver with eight drill points, a counter-sink to use in same tool, No. 11 ratchet screw driver with 6 inch blade, No. 15 ratchet screw driver with finger turn on 3 inch blade. The combination in this set covers the tools most in demand. They are easily removed from the box and held firmly in place when not in use. A descriptive circular together with prices will be sent upon application to the above company.